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ABSTRACT

This annotated bibliography focuses on the ethological study of child development and the educational process. Topics covered include: (1) evolution; (2) dominance hierarchies and social organization; (3) agonistic, affiliative, and epistemic behaviors; (4) nonverbal communication; (5) play; (6) biological constraints on learning; and (7) relevant methodological concerns. The first section of the bibliography contains brief annotations of journal articles and monographs. In the second section, references selected from the first section are reviewed in greater depth and summarized. This is one of a series of reports that form a part of the initial phase of a project to develop an ecological theory of teaching. The intent of this series is to provide access to the concepts, paradigms, and findings of the disciplines selected for review. The long-range goal of the project is the development of a theory of teaching that approaches and views classroom teaching and learning from an ecological perspective. (JD)

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ANNOTATED BIBLIOGRAPHY ON ETHOLOGY IN EDUCATION

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Report ETT-78-6d

This paper has been produced under the direction of
William J. Tikunoff and Beatrice A. Ward,
Principal Investigators.
It is part of the process of developing and
implementing an ecological theory of teaching.

INTRODUCTION

This is one of a series of reports by the Far West Laboratory for Educational Research and Development concerned with developing an ecological theory of teaching. Under funding by the National Institute of Education, the project has been underway since December 1977 and is projected to continue contingent upon funding from NIE.

Overall long-range goals of the program are four. An initial goal is the development of a theory of teaching that approaches and views classroom teaching and learning from an ecological perspective. Such a perspective builds from knowledge about teaching/learning in the teacher-student learning group as a sociological as well as a psychological process. An underlying assumption is that, previously, only a psychological perspective has been attended to. Thus, disciplines outside educational psychology will be utilized, e.g. human ethology, sociology, anthropology, environmental psychology, human ecology, communications theory, etc., such that a holistic approach to developing the theory will be used.

Attendant to the theory construction and growing out of efforts to pilot test initial constructs and interrelationships is the development of appropriate research methodologies, the second long-range goal. Both qualitative and quantitative methodologies will have to be examined and those selected which provide a "fit" with the phenomena being examined. In addition, these will have to be piloted toward utilization in the testing of the theory.

A third goal is the development and implementation of strategies--both inservice and preservice--which can be used to train teachers and others to utilize the ecological perspective. Such strategies are perceived as being

more sociological in nature than those previously employed. In addition, it is quite likely that not only teachers but all those involved in interacting with teacher and learner groups--students, principals, other adults, etc.--will need to be reoriented to this perspective.

Finally, as a fourth goal, a restructuring experiment in nature is proposed in order to test the theory in operation. Exactly how the experiment will be designed and conducted is the focus for developmental efforts growing from both the development of methodologies and identification of theoretical constructs and (re) training strategies.

The annotated bibliographies and the longer reviews of selected references presented here are part of the initial phase of developing an ecological theory of teaching. The intent of this work is to provide access to the concepts, paradigms and findings of the disciplines selected for review, and to utilize the knowledge and perspectives of those disciplines to illuminate the concerns of an ecological theory of teaching. We see this process of cross-fertilization to be continuous and additive, and have designed the following format to reflect this assumption.

The results of each disciplinary exploration appear on different colors of paper: Cognitive Anthropology and Sociolinguistics (white); Environmental Psychology (brown); Human Ecology (yellow); Human Ethology (green); Sociology (ivory). The individual annotated bibliographies are paginated by topic; the longer reviews which make up the second part of this document are paginated by reference. There is no consecutive pagination, as we intend these bibliographies and reviews to be open-ended, and ready to receive future contributions.

The following annotated bibliography and longer reviews focus on the ethological study of child development and the educational process. Topics covered include evolution, dominance hierarchies and social organization, agonistic, affiliative and epistemic behavior, non-verbal communication, play, biological constraints on learning and relevant methodological concerns. The work was conducted by Kevin Miller and Susan Frey of the Institute of Child Development, University of Minnesota. We are grateful for their efforts on our behalf. We would also like to thank Dr. William Charlesworth, also of the Institute of Child Development, University of Minnesota, for his guidance and advice in the preparation of this document.

William J. Tikunoff
Beatrice A. Ward
Principal Investigators

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SELECTED IN-DEPTH REVIEWS

ANNOTATED BIBLIOGRAPHY

A. Evolution

Dobzhansky, T., Ayala, F., Stebbins, G. & Valentine, J. Evolution.
San Francisco: W. H. Freeman, 1977.

Presents a comprehensive, up-to-date discussion of evolutionary theory.

Slobodkin, L. & Rapaport, A. An optimal strategy of evolution. The Quarterly Review of Biology, 1974, 49, 181-200.

General discussion of evolution. Describes a game, "Gambler's Ruin," analogous to evolution: You play against Nature and try to stay in the game--the only way to leave is via "ruin" (death). Includes a discussion of learning (pp. 192-193), e.g., "learning is meaningful in responding to events which are reasonably irregular in their occurrence, so that strict genetic programming is impossible, but which occur with sufficient frequency that a lesson learned in early life can be put to use in later life."

B. Ethology

- Eibl-Eibesfeldt, I. Ethology. N.Y.: Holt, Rinehart & Winston, 1970.
General overview of ethology. Discusses the evolution of tool use and language in humans (pp. 458-463). Describes humans as having more motivations with definite correlated motor patterns, such as a drive to speak.
- Hinde, R. Animal behaviour, (2nd Edition). N.Y.: McGraw-Hill, 1970.
Attempts to integrate ethology and comparative psychology, comparing findings from each in discussing theoretical foundations of the development of perception, motivation, social behavior, and learning. An overview.
- Lorenz, K. Studies in animal and human behavior. Cambridge: Harvard U. Press, 1970, Vols. I & II.
Extensive discussion of methods and findings of ethology with respect to a broad gamut of species. Extensive discussion of "preconditions for human evolution," and describes homo sapiens as the extreme example of a particular type of organism, "the specialist in non-specialization" (The Norway rat is another, less extreme example.)
- Tinbergen, N. Forward to N. Blurton-Jones, Ethological studies of child Behavior. London: Cambridge U. Press, 1972.
A brief history of ethology, emphasizing the danger of "ethologism" and the need for human ethogram construction. Criticizes: "preoccupation with too few phenomena and too few methods, and with theoretical weaknesses that have characterized psychology for a long time."
- Tinbergen, N. The study of instinct. Oxford: Oxford U. Press, 1951.
Overview of ethology, including human ethology. General discussion of aims and methods of the ethological approach.

II. Content relevant to education

A. Dominance hierarchies and social organization

Bartlett, D. & Meier, G. Dominance status and certain operants in a communal colony of rhesus macaques. Primates, 1971, 12, 209-219.

In phase I, a dominance hierarchy was identified using agonistic interactions as indices. In phase II, it was found that the more dominant animals bar-pressed at slower rates for longer blocks of time and that individual differences in rate did not covary with change in social context.

Chance, M. Attention structures as the basis of primate rank orders. Man, 1967, 2, 503-518.

This article discusses the underlying similarities in the rank orders and accompanying attention structures in primates and the relevance of primate studies for human behavior.

Dawkins, R. Hierarchical organization: A candidate principle for ethology. In P. Bateson & R. Hinde (Eds.), Growing points in ethology. London: Cambridge U. Press, 1976.

Suggests that organization into hierarchies is ethology's main contribution to an understanding of behavior and discusses it with reference to social networks, decision making, and behavioral organization in general.

Deag, J. Aggression and submission in monkey societies. Animal Behavior, 1977, 25, 465-474.

Shows that the hierarchies existing in nature are supported and maintained by activity of both dominants and subordinates. Suggests that instead of always functioning to reduce aggression (Tinbergen, 1964), dominance hierarchies may be explained simply as a result of individuals maximizing their fitness (Williams, 1966, Adaptation and natural selection).

Drickamer, L. Patterns of space utilization and group interactions among free-ranging *Macaca mulatta*. Primates, 1975, 16, 23-33.

Some conclusions were: larger groups were dominant, having freer use of space; smaller groups were continually forced to move.

Edelman, M. & Omark, D. Dominance hierarchies in young children. Social Science Information, 1973, 12, 103-110.

In a study of children from nursery school to 4th grade, stable dominance hierarchies were identified. The authors suggested that the hierarchy may provide necessary social experience for the development of the logical operation of seriation.

Garlan, J. Structure and function in primate society. Folia Primatologica, 1968, 8, 89-120.

This theoretical paper discusses the adequacy of the concept of social dominance as descriptive of primate social structure and proposes an alternative concept--social role differentiation.

Konner, M. Relations among infants and juveniles in comparative perspective. In M. Lewis & L. Rosenblum (Eds.), Friendship and peer relations, N.Y.: Wiley, 1975.

The observations and ethological analysis suggest that the peer group is an artifact of industrial society; in smaller societies, multi-age groups are more common (thus, education is more of an issue for us). "Humans didn't evolve for peer relations at all."

McGrew, W. Aspects of social development in nursery school children with emphasis on introduction to the group. In N. Blurton-Jones (Ed.), Ethological studies of child behavior, London: Cambridge U. Press, 1972. Looked at interaction between new child and group (ages 3-4 years).

McGrew, W. An ethological study of children's behavior. N.Y.: Academic Press, 1972.

Describes methods in some detail. Includes observations of several preschools with respect to sex differences, dominance hierarchies, and density and periodicity of behavior. Found support for dominance hierarchy.

Nishida, T. Social behavior and relationships among wild chimpanzees of the Mahali mountains. Primates, 1970, 11, 47-87.

This paper describes patterns of social behavior, including agonistic and friendly interactions, behavior in uncertainty, dominance, tolerance, and leadership. The patterns were found to be consistent with those describe in studies of other groups of chimpanzees.

Omark, D. & Edelman, M. The development of attention structures in young children. In M. Chance & R. Larsen (Eds.), Attention structures. N.Y.: John Wiley, in press.

The social structures in groups of children are discussed in terms of their effect on children's cognitive development, in particular, changes in their perceptions of themselves and others within dominance hierarchies.

Savin-Williams, R. An ethological study of dominance formation and maintenance in a group of human adolescents. Child Development, 1976, 47, 972-979.

Some of the findings are as follows: 1) High concordance between 8 observational indices of dominance behavior 2) one boy changed his dominance position midway in the study, due to intervention by the dominant boy, in part 3) a hierarchy emerged by day 3 4) hierarchy was relatively stable across settings, with the least number of transgressions against the hierarchy at meals and the most at rest time 5) there was a preponderance of verbal over physical displays of dominance and 6) the highest and lowest boys in the hierarchy were well liked, one for status and the other because he was non-threatening.

Savin-Williams, R. Dominance in a human adolescent group. Animal Behavior, 1977, 25, 400-406.

Used the Altmann (1974) method to observe 6 boys at camp over 35 days, recording all dominance interactions. There were high correlations between observed hierarchy and that reported by boys on ratings for toughness. Correlates of dominance were athletic ability, leadership, and bed position (near counselor). Fights decreased greatly after the hierarchy was established (day 3).

Savin-Williams, R. Dominance during early adolescence: Behaviors and hierarchies. In D. Freedman, D. Omark, & F. Strayer (Eds.), Dominance relations: An ethological perspective on human conflict, in press.

Presents the results of three studies which demonstrate the existence of a dominance hierarchy in male adolescent groups over time and settings.

Slukin, A. & Smith, P. Two approaches to the concept of dominance in preschool children. Child Development, 1977, 48, 917-923.

A modest correlation between observed dominance and perceived dominance was found in preschoolers. The observed hierarchy showed no intransitivity, but not all dyads could be ranked (some did not fight).

Smith, P. Aggression in a pre-school playgroup: Effects of varying physical resources. In J. DeWit & W. Hartup (Eds.), Determinants and origins of aggressive behavior, The Hague: Mouton, 1974.

Observed preschool children while varying physical space and resource (toys) available. Observed agonism. Found toys had an effect on agonism but space available did not.

Strayer, F. & Strayer, J. An ethological analysis of social agonism and dominance relations among preschool children. Child Development, 1976, 47, 980-989.

The authors contend that one cannot assess dominance with respect to a single type of social interaction, particularly in artificial settings. Agonism and dominance are said to be responses to aggression as well as initiation. Methods used were videotape, behavioral inventory, and interobserver reliability for physical attack, threat gestures and object/position struggle. There were different (but correlated) hierarchies for each method. Amount of aggressive interaction was not well correlated with dominance.

Vaith, E. Experimental analysis of the nature of social context in captive groups of squirrel monkeys. Primates, 1977, 18, 849-859.

This experiment examined the effects of systematic removal and return of individuals on the distributions of non-agonistic interactions and prolonged contacts among remaining group members. One conclusion was that not all of the dyadic relationships affect all others in a social group.

Vessey, S. Interactions between free-ranging groups of rhesus monkeys. Folia Primatologica, 1969, 228-239.

The study is a "descriptive, quantified account" of intergroup behavior of three social groups of monkeys. The involvement of individuals with different roles (e.g. central male, peripheral male) in interactions was studied, in particular.

Waterhouse, M. & Waterhouse, H. Primate ethology and human social behavior. In R. Michael & J. Crook (Eds.), Comparative ecology and behavior of primates, N.Y.: Academic Press, 1973.

Discusses group formation and processes in both nursery school children and sub-human primates from an ethological perspective.

Zivin, G. On becoming subtle: Age and social rank changes in the use of a facial gesture. Child Development, 1977, 48, 1314-1321.

Presents behavioral definitions of facial expressions and the consequences of a verbal (perceived) hierarchy. There was a weak correlation for 4- and 5-year-olds between dominance quartile and plus-face (which may well be due to weakness of dominance measure). There was a significant correlation for 7- to 10-year-olds between incidence of plus face in top and bottom halves. Top-ranking 7-10 year-olds gave few plus faces in agonistic interactions; 4-5 year-olds almost always did.

B. Agonistic behavior

- Blurton-Jones, N. An ethological study of some aspects of social behavior of children in nursery school. In D. Morris (Ed.), Primate ethology, Chicago: Aldine, 1967.
Results of a study of 3- to 5-year-olds suggested no unitary dominance. There were fights over property and little else. Includes behavioral description of the hitting and rough-and-tumble play pattern.
- Elton, R. & Anderson, B. The social behavior of a group of baboons under artificial crowding. Primates, 1977, 18, 225-234.
With forced crowding (by moving of the cage wall to reduce space by 50%) agonistic and sexual behavior increased, the dominance hierarchy was maintained, and infants and females on the lower end of the hierarchy became socially withdrawn.
- Ginsburg, H., Pollman, V. & Wauson, M. An ethological analysis of nonverbal inhibitors of aggressive behavior in male elementary school children. Developmental Psychology, 1977, 13, 417-418.
Appeasement gesture of "making oneself smaller" was observed just prior to cessation of aggression. Darwin's (1872) idea. Videotaped aggressive incidents, naive observers measured (with rulers) body stature on film before and near end of incidents. Noted high incidence of shoe-tying. Noted similarity to wolf, etc., with respect to appeasement gestures.
- Hinde, R. The study of aggression--determinants, consequences, goals, and functions. In J. DeWit & W. Hartup, (Eds.) Determinants and origins of aggressive behavior. The Hague: Mouton, 1974.
Suggests need for functional study of aggressive behaviors, e.g., display function of threat postures. Criticizes energy or catharsis models of aggression.
- Lorenz, K. Ritualized fighting. In J. Carthy & F. Ebling, The natural history of aggression. N.Y.: Academic Press, 1964.
Discusses ritualized displays in many species as means of limiting danger of intraspecific aggression.
- Mackintosh, D. & Stewart, G. A mathematical model of communal disorder. Human Biology, 1972, 44, 215-223.
A mathematical model describing the development of a riot among riot-prone individuals is presented. It is suggested that the model has general application to any situations involving a change from ordered to disordered state.
- Tokuda, K. & Jensen, G. The leader's role in controlling aggressive behavior in a monkey group. Primates, 1968, 9, 319-322.
This study found that dominant male played major role in controlling aggression. Aggression was higher during periods when the leader was absent and decreased when he was returned.
- Tymitz, B. & Omark, D. A naturalistic observation of verbal discipline modeling in a first grade classroom. Instructional Science, 1978, 7, 81-94.
Three observational methods (Ad. Lib., Focal Individual, and All Occurrences of Some Behaviors) were used to compare the verbal disciplinary techniques (called managing, threatening, and describing) used by a student teacher and a regular teacher and the incidence of student modeling those behaviors.

C. Affiliative behavior

Simpson, M. Social displays and the recognition of individuals. In P. Bateson & P. Klopfer (Eds.), Perspectives in ethology, Vol. I, N.Y.: Plenum, 1973. Reviews social displays and discusses varying consequences of displays in various species, with general consequences of establishing and maintaining relationships between individuals.

Porter, R., Ramsey, B., Tremblay, A., Iaccobo, M. & Crawley, S. Social interactions in heterogenous groups of retarded and normally developing children: An observational study. In G. Sackett (Ed.) Observing behavior: Theory and applications in mental retardation. Vol. I. Baltimore: University Park Press, 1978.

Provides an ethological description of childrens' behavior, focusing on patterns of interpersonal spacing and social preferences. Finding: non-retarded children showed preference for other non-retarded children, while retarded children displayed no preference for other retarded children over normal children.

Wickler, W. The ethological analysis of attachment: Sociological, motivational, and sociophysiological aspects. Zeitschrift fur Tierpsychology, 1976, 42, 12-28.

This article provides an operational definition of attachment and discusses some causes and effects of attachment, using concepts from sociobiology. Since the social system in school is based on a network of attachments, the principles discussed here may be relevant to education.

D. Non-verbal communication

- Argyle, M. Non-verbal communication in human social interaction. In Hinde (Ed.), Non-verbal communication, Cambridge: Cambridge U. Press, 1972.
Review of methods and findings. Functions: managing immediate social situation, self-presentation, sustaining verbal communication.
- Blurton-Jones, N. Non-verbal communication in children. In Hinde, (Ed.), Non-verbal communication, Cambridge: Cambridge U. Press, 1972.
Offers behavioral taxonomy of gestures in infants to 5-year-olds.
Suggests function as means of controlling interaction.
- Brannigan, C. & Humphries, D. Human non-verbal behavior, a means of communication. In N. Blurton-Jones (Ed.), Ethological studies of child behavior, London: Cambridge U. Press, 1972.
Discusses development of facial signalling in natural environments.
- Camras, L. Facial expressions used by children in a conflict situation. Child Development, 1977, 48, 1431-1435.
This study looked at pairs of children in a play setting with one object. Coded facial expressions after Blurton-Jones (1971). Either aggressive expressions or a "sad" expression (oblique brows) led to a decrease in challenge by non-player signally "determination." Responsiveness to facial distress cues were examined.
- Charlesworth, W. & Kreutzer, M. Facial expressions of infants and children. In P. Ekman (Ed.), Darwin and facial expression. N.Y.: Academic Press, 1973.
Reviews Darwin's early observations on facial expression of emotions and subsequent work. Notes that his conclusions have generally held up and discusses use of observational methods in studying facial expressions.
- Cheyne, J. Development of forms and functions of smiling in preschoolers. Child Development, 1976, 47, 820-823.
Observation of smiling in 2-5 year-old preschoolers. Found three types of smiles: upper (teeth exposed), closed (no teeth), and broad (upper and lower teeth). Upper smile increased with age, interactions: broad smile more selective with age; boys reserve upper smile for boys by age.
- Eibl-Eibesfeldt, I. Similarities and differences between cultures in expressive movements. In R. Hinde (Ed.), Non-verbal communication, Cambridge: Cambridge U. Press, 1972.
Looking at films using an angle lens (so subjects are unaware of being filmed), describes many similarities, e.g., eyebrow flash in greeting, both cross-culturally and across species, also in deaf and blind children. Also discusses how display of expressions is controlled by different cultures.
- Ekman, P. Cross-cultural studies of facial expression. In P. Ekman (Ed.), Darwin and facial expression, N.Y.: Academic Press, 1973.
Reviews evidence for similarity in both posed and judge facial expressions in 13 literate cultures and 2 preliterate groups in New Guinea. Concludes that facial expressions are not an arbitrary language.
- Ekman, P., Friesen, W. & Ellsworth, P. Emotion in the human face. N.Y.: Pergamon Press, 1972.
Review of methods for studying facial expression and results suggesting great universality in facial expression.
- Maurus, M., Hartmann, E. & Kuhlmoegen, B. Invariant quantities in communication processes of squirrel monkeys. Primates, 1974, 15, 179-192.
Some rules for communication among monkeys were generated from data on the frequency of occurrence of behavioral units.

Maurus, M. & Pruscha, H. Classification of social signals in squirrel monkeys by means of cluster analysis. Behaviour, 1973, 47, 106-128. Using an agglomerative cluster method, this project attempted to reduce the large number of observational units of actions of squirrel monkeys by classifying them according to their function in the communication process.

van Koeff, J. A comparative approach to the phylogeny of laughter and smiling. In R. Hinde (Ed.), Non-verbal communication, Cambridge: Cambridge U. Press, 1972.

Reviews human and primate studies of laughter and smiling. Phylogenetic similarities of behavior itself are noted. "Originally reflecting an attitude of submission, this display has come to represent non-hostility and finally has become emancipated to an expression of social attachment or friendliness.

Wolfheim, J. & Rowell, T. Communication among captive Talapoin monkeys. Folia Primatologica, 1972, 18, 224-255.

The behavioral repertoire of 18 monkeys is described, including the following features: postures and body gestures, locomotion, facial gestures, noises, aggressive behavior, grooming, sexual behavior, and play.

E. Epistemic behavior

Andrew, R. Attentional processes and animal behavior. In P. Bateson & R. Hinde (Eds.), Growing points in ethology. London: Cambridge U. Press, 1976.

Discusses human models of attention (e.g. filtering or response set) and describes effects of testosterone on search behavior in chicks and mice. In general, testosterone functions to increase attention as measured by persistence of search, responsiveness to novelty and ability to ignore irrelevant stimuli.

Beck, B. Baboons, chimpanzees, and tools. J. of Human Evolution, 3, 509-516.

Wild chimpanzees make and use tools much more frequently than baboons. In Gombe reservation, where both species live together and compete for resources, baboons rarely use tools or learn from watching chimps use tools. In fights between them, chimps were observed on several occasions to throw objects at baboons, but the reverse was never seen. Chimps appear to learn to make and use tools through observation. Suggests that advent of hominoid tool tradition accompanied by capacity for facile observational learning.

Beck, B. A study of problem solving by gibbons. Behaviour, 1967, 28, 95-109.

Four gibbons solved string-pulling problems quickly and efficiently, partly due to the design of the apparatus. Sequences of behaviors that seemed to demonstrate solution by insight were observed.

Charlesworth, W. Ethology: Its relevance for observational studies of human adaptation. In G. Sackett (Ed.), Observing behavior: Theory and applications in mental retardation. Vol. I. Baltimore: University Park Press, 1978.

Some characteristics of ethology and its potential application to the study of human adaptation are discussed. An empirical study of problem solving in 2 young children in their natural environments is presented.

Charlesworth, W. Ethology's modest contribution to the assessment of education. Research Report of the Mathemagenic Program, Athens, Georgia, November, 1972.

Notes that industrial society education differs from that in chimps, and possibly in non-industrial societies: learner cannot see the consequences of learning. Two contributions of ethology are:

- 1) study of consequences of education with respect to environment and
- 2) naturalistic observation.

Charlesworth, W. Ethology: understanding the other half of intelligence. Paper presented in the symposium: Human ethology: claims and limits of a new discipline. Bad Homburg, Germany, October, 1977.

Reviews research on intelligence after Galton (1869). Notes that I.Q. tests in general account for up to 30-40% of the variance in academic achievement. The "other half": what intelligence actually does for the individual when it is expressed in everyday behavior. This is discussed in the context of evolutionary theory and the application of methods of naturalistic observation. A study is presented on problem solving in 2 children, a normal and a Down's syndrome.

- Charlesworth, W. Human intelligence as adaptation: An ethological approach. In L. Resnick (Ed.), The nature of intelligence. Hillsdale: Erlbaum, 1976. A general discussion of the psychometric study of intelligence. Cites failure to focus on: 1) criteria for life success 2) adaptation to specific environments. Ethology is discussed as: 1) paleopsychocomparative, i.e. logical structures behind social hierarchies 2) studying situation-specific behavior 3) studying failure to adapt, and 4) using naturalistic observation.
- Charlesworth, W. and Bart, W. Some contributions of ethology for education. Educational Studies, 1976, 7, 258-272. Ethology's contributions relate to: 1) learning as adaptation to present/future environment 2) species comparison 3) phylogenetic-ontogenetic sources, e.g. readiness and 4) naturalistic observation.
- Charlesworth, W., Kjergaard, L., Fausch, D., Daniels, S., Binger, K. & Spiker, D. A method for studying adaptive behavior in life situations: a study of everyday problem solving in a normal and Down's syndrome child. Center in Education of Handicapped Children Development Report No. 6, U. of Minnesota, Minneapolis, Minnesota, October, 1976. Naturalistic observation of problems, looking at context, block, ongoing behavior, response, result, and outcomes as parts of the problem-solving sequence. Includes a lengthy discussion of methods and training.
- Charlesworth, W. and Spiker, D. An ethological approach to observation in learning settings. In R. Weinburg & F. Wood (Eds.), Observation of pupils and teachers in mainstream and special education settings: Alternative strategies. U. of Minnesota Leadership Training Institute, 1975. A review of ethological theory as applied to humans. Observational child psychology work from 1930's either not sufficiently comprehensive, detailed, or objective, or not in the theory of evolution. Methods must be amenable to cross-species comparisons and precise and unambiguous in choice of behavioral units. Includes discussion of an empirical study of problem solving in preschool children.
- Eibl-Eibesfeldt, I. Love and hate. N.Y.: Holt, Rinehart & Winston, 1972. Dismisses idea of man as a "human beast" controlled by culture as a caricature. Sees both aggressive and attachment/bond-forming urges as innate human characteristics and sees this preprogramming as a fact which must be taken into account by educators. In particular, feels that a personal bond with caretaker is critical to learning to love. Sees learning as development of "cultural formulas to govern our drives."
- Hall, K. Tool-using performances as indicators of behavioral adaptability. Current Anthropology, 1963, 4, 479-494. Reviews evidence of tool-using behavior in different animals and emphasizes the importance of examining the context of the animal's capacities and ecological settings in making comparative analyses of its nature and function.

- Harlow, H. The evolution of learning. In A. Roe & G. Simpson (Eds.), Behavior and evolution. New Haven: Yale U. Press, 1958.
Discusses difficulty of understanding the evolution of learning, since "learning leaves no fossils." According to anatomical evidence, sees gradual increase in learning capacity phylogenetically following increased perceptual ability. Raises the problem of how learning abilities shown in laboratories but not in nature could contribute to inclusive fitness, but believes any improved perception is likely to be adaptive, and that this increase in perceptual ability makes learning inevitable.
- Humphrey, N. The social function of intellect. In P. Bateson and R. Hinde (Eds.), Growing points in ethology. London: Cambridge U. Press, 1976.
Is human intelligence an extravagance? Notes that the physical environments of the most intelligent animals, e.g. chimpanzees, gorillas, men, are comparatively uncomplicated, and that a primate who is part of a subsistence technology has less need of individual inventiveness than one without one. Suggests that the complexity of social life necessitates the development of intelligence in higher primates, because within a society an individual's adversaries are also members of the breeding community, and a trait that increases an individual's ability to outwit his fellow will soon spread through the gene pool. The need for schooling (to teach technology) leads to a more complex society (to support the dependent students) which in turn creates pressure for increased intelligence (to deal with a complex society). This is regulated by balance between increased productivity due to technology and loss in productivity due to schooling and "socializing."
- Ibuka, N. The relationship between visual exploratory behavior and spontaneous activity in Rhesus monkeys. Primates, 1970, 11, 201-214.
It was found that the peeping responses (measures of exploratory behavior) of monkeys were not correlated with measures of spontaneous activity.
- Konner, M. Aspects of the developmental ethology of a foraging people. In N. Blurton-Jones (Ed.), Ethological studies of child behavior, London: Cambridge U. Press, 1972.
Discussed ethological method in studying !Kung Bushmen. Focussed on infants and paternal behavior. Considers adaptive function of attachment both in terms of protection from predation and in facilitating learning.
- Miyadi, D. Social life of Japanese monkeys. In P. Klopfer & J. Hailman (Eds.), Function and evolution of behavior, Reading: Addison-Wesley, 1972.
Notes cultural differences in groups of Japanese monkeys--some eat eggs, some eat rice, soybeans, and others don't. Some troops permit mounting of non-estrous females, most do not. Paternal care of babies only found in one troop. Infants first tried new foods, then imitated by mother, then others. Washing sweet potatoes started by a 1-1/2-year-old female, imitated by mother and a playfellow, then sisters and brother, finally by most of troop except old males. New troops seemed to form suddenly.
- Parker, C. The antecedents of man the manipulator. J. of Human Evolution, 1974, 3, 493-500.
Presented members of various primate species with a length of nylon rope and recorded manipulative behavior. Found that those presumed to be antecedents to man (great apes, macaques) showed more and more varied manipulation than the rest (lemurs, gibbons, and arboreal fruit and leaf-eating monkeys).

Strayer, F. Learning and imitation as a function of social status in macaque monkeys. Animal Behavior, 1976, 24, 835-848.

Picked high- and low-dominance monkeys from two groups and put them in an observational learning task or a learning task (no model). Exposure to male led to increased learning of this cued-alternation task. High dominant monkeys responded more overall, but were less successful in learning not to respond when not reinforced. Suggests high dominant monkeys acting to increase reward and low dominant monkeys to decrease non-reward. Relates this to social organization observed in the field.

Tinbergen, N. The innate disposition to learn. In M. Seligman & J. Hager (Eds.), Biological boundaries of learning. N.Y.: Appleton-Century-Crofts, 1972.

Discusses concepts of localized dispositions to learn, preferential learning, and critical periods with respect to a number of sub-primate species.

van Lawick-Goodall, J. In the shadow of man. Boston: Houghton-Mifflin, 1971.

Description of chimpanzees in the Gombe stream area of Tanzania, including description of learning. Weak methodological but interesting.

Warren, J. Possibly unique characteristics of learning by primates.

J. of Human Evolution, 1974, 3, 445-459.

Says that quantitative comparisons of learning in different species are frequently misleading due to impossibility of equating test conditions. At the same time, suggests primates show a unique ability to develop generalized trans-situationally valid strategies during training on a particular, specific problem.

F. Play and its educational function

Aldis, O. Play fighting. N.Y.: Academic Press, 1975.

Ethological discussion of play, with extended discussion of human play: types of behavior settings in which they occur, sex differences. Suggests function is development of physical strength of aggressive repertoire and control over it.

Baldwin, J. & Baldwin, J. The role of play in social organization: comparative observations on squirrel monkeys. Primates, 1973, 14, 369-381.

Presents data on friendly, aggressive, sexual, and spacing behavior in squirrel monkeys indicating that social play is not necessary for development of group cohesion, but that it does provide a means by which animals can develop more complex, varied social interaction patterns.

Bekoff, M. The development of social interaction, play, and metacommunication in mammals: An ethological perspective. Quarterly Review of Biology, 1972, 47, 412-434.

Review of human, primate, and wolf literature on play. Suggests that play serves the function of teaching young animals to understand intraspecific communication, metacommunication, establishes peer relations (dominance, etc.).

Gard, G. & Meier, G. Social and contextual factors of play behavior in sub-adult Rhesus monkeys. Primates, 1977, 367-377.

The observational study reported here was an investigation of the effect of dominance, gender and age (social factors) and temperature, activity, vocalization, and cloud cover (contextual factors) on the development of play behavior. All factors except cloud cover had an effect on play behavior.

Smith, P. & Connolly, K. Patterns of play and social interaction in preschool children. In N. Blurton-Jones (Ed.), Ethological studies of child behavior, London: Cambridge U. Press, 1972.

Discusses weakness of early (1930's) observational studies with respect to units of behavior, levels of analysis, sampling techniques, reliability, and data analysis. Conducted their own study and compare with earlier study (Arrington, 1931).

G. Biological constraints on learning

1. Maturational

Fullard, W. & Reiling, A. An investigation of Lorenz's 'Babyness'. Child Development, 1976, 47, 1191-1193.

"Babyness" (large head in proportion to body, protruding forehead, large eyes, round, protruding cheeks) discussed as a releaser for care-taking. Strong shift in females' preference for baby slides between grades 6 and 8. Lesser shift for males, although at chance level until grade 12. Used both human and animal slides, no effect for human vs. animal.

Sternglanz, S., Gray, J. & Murakami, M. Adult preferences for infantile facial features: An ethological analysis. Animal Behavior, 1977, 25, 108-115.

Looked at preference for "babyness". found general support.

2. Sex differences

Alvarez, F. Conditions of observation and social distance in groups of squirrel monkeys. Primates, 1975, 16, 465-470.

The visibility of the observer was shown to affect the monkeys' pattern of social interaction, as measured by distance between individuals during play. Females appeared to be more cohesive than males.

Blurton-Jones, N. & Konner, M. Sex differences in behaviour of London and Bushman children. In R. Michael & J. Crook (Eds.), Comparative ecology and behaviour of primates, N.Y.: Academic Press, 1973.

Compared London and !Kung Bushman 3-6-year-olds. Found boys greater than girls in agonistic categories for both groups, but found boys greater than girls for rough-and-tumble play categories only for London sample. (Bushman girls greater than London girls.) Boys interact more with children than adults, opposite for girls in both cultures. London boys slightly greater than girls in activity, but no differences for Bushman.

Brindley, C., Clarke, P., Hutt, C., Robinson, I. & Wethli, E. Sex differences in the activities and social interactions of nursery school children. In R. Michael & J. Crook (Eds.), Comparative ethology and behavior of primates. N.Y.: Academic Press, 1973.

Observed 3-5-year-old preschoolers. Results suggest sex differences in agonism (male greater than female), cooperation (female greater than male, excluding games), physical play (male greater than female), social, and constructional play (male greater than female).

Chamove, A., Harlow, H., & Mitchell, G. Sex differences in the infant-directed behavior of preadolescent Rhesus monkeys. Child Development, 1967, 38, 329-336.

Male and female preadolescent Rhesus monkeys reared identically differed in behavior toward infant as follows: males showed significantly more hostility; females showed significantly more positive social behavior.

- Rabinovitz, F., Moely, B., Finkel, N. & McClinton, S. The effects of toy novelty and social interaction on the exploratory behavior of preschool children. Child Development, 1975, 46, 286-289.
Found more exploration in social condition. Boys spent more time with novel toy than girls, but not in exploration. Sex differences found in diversive (playful) but not specific (information-gathering) exploration. Not strictly in the ethological tradition.
- Sherman, L. An ethological study of glee in small groups of preschool children. Child Development, 1975, 46, 53-61.
Group glee occurred most often in mixed-sex groups moderate in size (7-9 children). Did not specify behavior well. Possible sexual signal system, a precursor to flirtation, sexual interaction.
- Smith, P. & Green, M. Aggressive behavior in English nurseries and play groups: Sex differences and response of adults. Child Development, 1975, 46, 211-214.
Group level of analysis (used 15 groups). Used incident sampling. Aggression, not rough-and-tumble play, defined by consequences. Some results are as follows: Boys more aggressive than girls; had 40% adult intervention; the initiator was successful 49% of the time. Suggests that sex differences in aggression not caused by differential adult reinforcement in preschool setting.
- Smith, P. & Daglish, L. Sex differences in parent and infant behavior in the home. Child Development, 1977, 48, 1250-1254.
Observed 1-2-year-old infants at home. Sex differences: males increased in active play, transportation of toys, and forbidden play. Females more involved with soft toys and dolls. Parents rated these as sex-appropriate on questionnaire, but no difference in behavior toward males vs. females in infants observed, although the trend increased toward punishment of males.
- Strayer, F., Taylor, M. & Yanciw, P. Group composition effects on social behavior of captive squirrel monkeys. Primates, 1975, 253-260.
Two experiments were conducted to examine the effects of group composition on agonistic and affiliative behavior of adult males and females. Females tended to be more active and engaged in more affiliative interactions in the all-female group.

3. Individual differences

- Leach, G. A comparison of the social behavior of some normal and problem children. In N. Blurton-Jones (Ed.), Ethological studies of child behavior, London: Cambridge U. Press, 1972.
Examines nursery interaction with mother and peers of "problem" (separation anxiety) and normal children ages 31-58 months.
- Smith, P. Temporal clusters and individual differences in the behavior of preschool children. In R. Michael & J. Crook (Eds.), Comparative ethology and behavior of primates. N.Y.: Academic Press, 1973.
Factor analysis of observations on preschoolers for individual difference dimensions finding a sociability/social maturity factor, an object manipulation factor, and a sex-difference factor: rough-and-tumble play.
- Tinbergen, E. & Tinbergen, N. Early childhood autism--an ethological approach. Zeitschrift fur Tierpsychologie, Supplement 10, 1972.
This paper argues for the systematic use of ethological methods in diagnosing and understanding autistic behavior.

III. Methodology

A. General ethological

- Bateson, P. Ethological methods of observing behavior. In L. Weiskrantz (Ed.) Analysis of behavioral change. N.Y.: Harper and Row, 1968.
A general description of ethological techniques as complement to traditional psychological experimentation.
- Black-Cleworth, P. Introduction to Observational methods in the study of language development. In G. Sackett (Ed.) Observing behavior: Theory and applications in mental retardation. Vol. I., Baltimore: University Park Press, 1978.
A brief description and comparison of ethological and developmental linguistic methods of studying relationships between animal vocalizations and human language.
- Blurton-Jones, N. Categories of child-child interaction. In N. Blurton-Jones (Ed.), Ethological Studies of child behavior, London: Cambridge U. Press, 1972.
Provides behavioral categories. Shows rough-and-tumble play vs. aggression distinction. Includes factor analysis.
- Blurton-Jones, N. Characteristics of ethological studies of human behavior. In N. Blurton-Jones (Ed.), Ethological studies of child behavior. London: Cambridge U. Press, 1972.
Discusses the following ethological questions: 1) causation 2) development 3) survival value and 4) phylogeny. Presents observational study of interactions.
- Bowlby, J. An ethological approach to research in child development. British J. of Medical Psychology, 1957, 30, 230-240.
A review of the main characteristics of the ethological approach to child development research.
- Gottlieb, J. Observing social adaptation in schools. In G. Sackett (Ed.), Observing behavior: Theory and applications in mental retardation. Vol. I. Baltimore: University Park Press, 1978.
Presents a conceptual framework for studying social adaptation of the EMR child to school environment. Discusses communication skills, aggressive behavior, and aspects of the school setting.
- Lehrman, D. Ethology and psychology. In J. Wortis (Ed.), Recent advances in biological psychiatry. N.Y.: Plenum Press, 1962.
A general, descriptive paper about the ethological approach to studying child development.
- Moltz, H. The fixed action pattern: Empirical properties and theoretical implications. In Wortis (Ed.) Recent advances in biological psychiatry, 1962, N.Y.: Plenum, 69-85.
Properties of the fixed action pattern are discussed, including stereotypy, resistance to external control, and spontaneity. The author distinguishes the F.A.P. from traditional instinctive behavior.
- Omark, D. & Fiedler, M. Dominance hierarchies: Observational techniques applied to the study of children at play. Instructional Science, 1976, 5, 403-423.
This paper reviews research on sex differences and developmental change in social interactions in order to illustrate and evaluate different observational techniques. This is primarily of methodological interest.
- Reynolds, V. The origins of a behavioral vocabulary: The case of the Rhesus monkey. J. for the Theory of Social Behavior, 1976, 105-142.
A discussion of problems associated with defining behavioral units. Compares the behavioral units of different authors and discusses reasons for discrepancies.

Sackett, G. (Ed.), Observing behavior (Vol. II): Data collection and analysis methods. Baltimore: University Park Press, 1978.

Proceeds of the 1976 conference "Application of observational/ethological methods to the study of mental retardation." A methodological volume: six chapters devoted to methods and issues in observational research: development of taxonomies, reliability, recording techniques, data analysis (sequential and non-sequential), and general measurement issues.

Schleidt, W. How 'fixed' is the fixed action pattern? Zeitschrift fur Tierpsychologie, 36, 184-211.

Three kinds of stereotypy, or fixedness, of the elementary unit of behavior are distinguished: 1) completeness of pattern 2) sequence among the elements 3) variability of the pattern's physical characteristics.

Methods of measuring stereotypy of behavioral units are discussed.

Slater, P. Describing sequences of behavior. In P. Bateson & P. Klopfer (Eds.), Perspectives in ethology, Vol. I, N.Y.: Plenum Press, 1973.

General discussion of observational methods for studying interaction.

Considers several analytical models such as conditional probabilities, comparison, with a random mode) and the issue of determining behavioral categories.

B. Naturalistic observation

Altmann, J. Observational study of behavior: Sampling methods. Behavior, 1974, 49, 228-267.

This paper is an excellent summary of the strengths and weaknesses of seven sampling methods and provides useful recommendations for their use in observational studies.

Altmann, S. & Wagner, S. Estimating rates of behavior from Hansen frequencies. Primates, 1970, 11, 181-183.

A procedure for estimating rates of behavior by using the Poisson distribution is described. It is suggested that this procedure is more appropriate for brief events, e.g., glances.

Blurton-Jones, N. Criteria for use in describing facial expressions of children. Human Biology, 1971, 43, 365-413.

Describes 52 components of facial expression in children and includes comments on the way the facial muscles produce them.

Bobbitt, R., Gourevitch, V., Miller, L. & Jensen, G. Dynamics of social interactive behavior: A computerized procedure for analyzing trends, patterns, and sequences. Psychological Bulletin, 1969, 71, 110-121. Describes a procedure for making detailed, sequential observations of monkeys' interactive social behavior. The authors contend that this procedure is an effective and economical way to provide an extensive description of interaction that reveals the antecedents and effects of behavior patterns.

Box, H. & Pook, A. A quantitative method for studying behavior in small groups of monkeys in captivity. Primates, 1974, 101-105.

A method involving focal-individual sampling is described as being useful in early stages of studying social behavior.

Butler, S. & Rowe, E. A data acquisition and retrieval system for studies of animal social behavior. Behavior, 1976, 57, 281-287.

This report describes a simple, portable, inexpensive recording system and retrieval system for use when recording a large number of behavioral categories.

Chamove, A. A new primate social behavior category system. Primates, 1974, 15, 85-99.

This includes a critical review of some primate behavioral recording techniques and a description of a new scoring system designed to obtain frequency and duration data on a large number of behaviors.

Chow, I. & Rosenblum, L. A statistical investigation of the time-sampling methods in studying primate behavior. Primates, 1977, 18, 555-563.

Two time-sampling techniques, fixed interval time point technique and fixed interval time span technique were analyzed. The relative merits of the two approaches in estimating duration and frequency of a behavior are summarized in a table.

- Connolly, K. & Smith, P. Reactions of pre-school children to a strange observer. In N. Blurton-Jones (Ed.), Ethological studies of child behavior, 1972.
Responsiveness and novelty of observer led to increased approaches more so by younger preschool children.
- Dunbar, R. Some aspects of research design and their implications in the observational study of behavior. Behavior, 1976, 58, 78-98.
This paper addresses methodological issues in observational research and emphasizes the importance of the following in choosing behaviors to quantify: 1) clearly defining the problem at the start 2) allowing enough time for naturalistic observation before behaviors are quantified 3) using several different behavioral parameters and 4) considering the limitations of various sampling strategies.
- Eibl-Eibesfeldt, I. & Hass, H. Film studies in human ethology. Current Anthropology, 1967, 8, 477-479.
By using a special camera, the authors collected films of behavior such as flirting, smiling, greeting, and pot-making across cultures and found that much of the behavior patterns were the same cross-culturally. They interpret this as evidence for the existence of invariable complex human behavior patterns and stress the importance of continuing this work cross-culturally.
- Emory, B. The patterns of interaction between the young males and group members in captive groups of *Mandrillus shpinx* and *Theropithecus gelada*. Primates, 1975, 16, 317-334.
This paper provides an extensive taxonomy of behavior which could be used in studies of children. Some categories are the following: maintenance comfort, social orientation, play, social contact, agonistic interaction, acquiescent behavior.
- Fernald, R. & Heinecke, P. A computer compatible multi-purpose event recorder. Behavior, 1974, 48, 268-275.
Directions for operating a multi-mode event recorder for registering behavioral events directly on punched paper are provided.
- Hinde, R. On the design of check-sheets. Primates, 1973, 14, 393-406.
Guidelines for the design and use of checklists are presented, including the following aspects: nature of behavioral units, number and scope of categories, and physical arrangement of categories on the sheet.
- Hopf, S. Study of spontaneous behavior in squirrel monkey groups: Observational techniques, recording devices, numerical evaluation and reliability tests. Folia Primatologica, 1972, 17, 363-388.
Describes a method for quantifying social behavior of squirrel monkeys with application for observational studies of humans. Included in the report of the study are the following: behavioral units, analysis of frequency, duration and sequences of behavior.
- Hopf, S., Hartmann-Wiesner, E. Kuhlmoorgen, B. & Mayer, S. The behavioral repertoire of the squirrel monkey. Folia Primatologica, 1974, 21, 225-249.
A list of over 100 behavioral units with definitions is presented.
The problem of choosing criteria for splitting and lumping is discussed.

Hutt, S. & Hutt, C. Direct observation and measurement of behavior.
Springfield: Charles Thomas, 1970.

This book provides an excellent description of observational methods and includes studies illustrating their application. Chapter 1 discusses reasons for measuring behavior directly; Chapter 2 discusses the special characteristics of ethology as distinct from other observational approaches; Chapter 3 introduces "behavioral elements" and some problems associated with their definition; Chapters 4-6 present techniques of recording behavior; Chapter 7 considers various studies of social behavior in animals and humans which have applied the methods discussed in the book; Chapter 9 reviews four statistical models for analysis of behavioral sequences.

Kraemer, H., Alexander, B., Clark, C., Busse, C. and Riss, D. Empirical choice of sampling procedures for optimal research design in the longitudinal study of primate behavior. Primates, 1977, 18, 825-833.
In response to the problem of making sampling decisions before much is known about the population's behavior, the author discusses an "empirical technique," involving randomization of a pilot sample of behavior, and offers it as a guide for making early sampling decisions.

Leger, D. An empirical evaluation of instantaneous and one-zero sampling of chimpanzee behavior. Primates, 1977, 18, 387-393.
Advantages and disadvantages of the two procedures are discussed on the basis of the correlations of their results with those obtained by measuring percent of net observation time, hourly rate, and mean bout duration of the behavior categories.

Odom, B., Mitchell, G. & Lindburg, D. A device to record primate social behavior. Primates, 1970, 11, 93-96.
An event recorder is described as having many advantages over paper and pencil systems. The picture included depicts the recorder as a big machine--perhaps too big and clumsy for use with humans.

Plutchik, R. The study of social behavior in primates. Folia Primatologica, 1964, 2, 67-92.

In this review of methods of studying social behavior, five major issues are discussed: 1) general problems of research on primates 2) nature of the categories used to describe social behavior 3) sampling procedures 4) reliability of categories and 5) types of variables studied.

Prost, J. Varieties of human posture. Human Biology, 1974, 46, 1-20.

A field model, based on the author's finding that postural differences represent gradations between cluster, is presented for the description of human postures. The language model usually used is criticized because it represents postures as discrete entities.

Pruscha, H. & Maurus, H. A statistical method for the classification of behavior units occurring in primate communication. Behavioral Biology, 1973, 9, 511-516.

Deals with the problem of distinguishing behavioral units with respect to their function in the communication process.. Suggests that those units which are not "functioning in communication should be combined into classes, in order to increase the predictability of the successively occurring behavioral events.

SELECTED IN-DEPTH REVIEWS

SELECTED IN-DEPTH REVIEWS

From the preceding annotated bibliography, the Far West Laboratory staff has chosen selected references for longer in-depth reviews. These reviews appear on the following pages. To aid in the retrieval of relevant information, reviews are presented in the following format.

Bibliographic citation

1. Summary of the theory and/or main ideas in the book or article.
2. Major implications for a definition of teaching.
3. Major implications for studying teaching.
4. Categories and definitions given by the author.
5. How categories and definitions relate to the nine elements¹ presented below, or to interactions among/between any of these elements.
 1. Students
 2. Teachers
 3. Other human elements
 4. Role
 5. Time
 6. Place
 7. Task
 8. Standards and sanctions
 9. Communication

1. Working definitions and a brief discussion of these elements appear in Dawson, M. B., Tikunoff, W. J., and Ward, B. A. Toward an ecological theory of teaching: A starting point. San Francisco: Far West Laboratory for Educational Research and Development, nd.

6. If the source is reporting a study, describe the following:

- a) Behavior
- b) Setting
- c) Treatment
- d) Data sources and data collection methods used
- e) Data analysis procedures used

Authors of the reviews were asked to use this format to structure their reporting, but not to force-fit the content of their sources to it; thus, not every point in the above outline is covered in every in-depth review. These longer reviews are paginated according to the reference being reviewed; there is no consecutive pagination.

1. Summary: This paper emphasizes the importance of using appropriate sampling techniques as a non-manipulative means to increase internal validity of observational data. (See item 4)
3. Major implications of studying teaching: This article is written as an observer's guide to choosing among available sampling methods, each of which restricts in some ways the kinds of behavior that can be studied. The author discusses the advantages and disadvantages of seven sampling methods and gives her recommendations for their use in providing relatively unbiased observational data. Each of these methods (perhaps with the exception of One-Zero Sampling) could be used in classroom studies of student and teacher behavior.
 - a) Ad Libitum Sampling. This type of sampling consists of field notes in which one usually attempts to write down as much as possible, making unconscious sampling decisions. These notes can be useful in generating ideas, providing examples, and planning subsequent, more systematic sampling of behavior. Often, Ad Lib sampling provides a record of rare events that would not be recorded using other methods. However, the biases that result from the fact that some individuals or behaviors are more readily observed limit the usefulness of this method for quantitative analysis of behavior.
 - b) Sociometric Matrix Completion. This type of sampling involves the observation of pairs of individuals in order "to establish, for each pair, the direction and degree of one-sidedness of some relationship." (p.240). The data are tabulated in a contingency table in which the rows represent actors, columns represent recipients, and cells represent frequency of dyadic interactions. The cells do not provide an unbiased sampling of dyadic interactions but they do represent an unbiased sample of a pair of individuals' relations in their joint encounters.
 - c) Focal-Animal Sampling. In this method, all occurrences of certain actions of an individual as well as the amount of time the individual was actually in view are recorded during a set sample period. A group of individuals may be observed using this method, but it is recommended that individuals be observed one at a time. The simplest method for keeping a time record of the observation period is to sample for a pre-determined length of time. The sampling period could be ended according to a behavior-dependent stopping rule, in order to get an adequate sample size. However, if the research question is not explicitly formulated ahead of time, one should sample for a pre-determined amount of time to avoid biases in recording behavior. Focal-Animal Sampling can be used to answer questions about behavior as events or states, sequences of behaviors, and interactions between individuals. "It is least suited to answering questions about behavioral synchrony." (p.247)

d) Sampling All Occurrences of Some Behaviors. Some prerequisites for successful use of this method are as follows: 1) excellent observation conditions; 2) behaviors salient enough that all cases will be observed; 3) behaviors never occur too frequently to be recorded. This type of sampling can provide information about the rate of occurrence of behaviors in the whole group and about synchrony of behaviors (if they can be recorded simultaneously). This technique is not useful for recording long sequences of behaviors.

e) Sequence Sampling. Using this method, one focusses on interaction sequences rather than on individuals. A sample period extends from the onset of an interaction to its end or interruption. Sequence Sampling involves some problems, such as trying to select sequences at random and identifying the beginning and end of a sequence. However, it is the only method that can provide information about social interactions that persist without the continuous participation of any one individual.

f) One-Zero Sampling. In this procedure, one scores the occurrence or non-occurrence (rather than frequency) of behaviors for an individual or a pair of individuals in a series of very brief (e.g. 15 seconds) sample periods. This method is used widely in observational studies of humans, but the author suggests that it not be used at all, because of a major problem. One-Zero scoring does not provide good measures of time spent in various states or of frequencies. As Altmann points out, "a One-Zero Score is not the frequency of behavior but is the frequency of intervals that included any amount of time spent in that behavior." (pp. 253-254) And of course it would be unusual to find that the behavior studied took up all of the time in each interval in which it was scored, and none of the time in the others. Although obtaining high inter-rater reliability is easy in this method, the method's failure to provide accurate information about frequency and duration of behavior limits its usefulness.

g) Instantaneous and Scan Sampling. This method resembles One-Zero Sampling in that the observer records behavior during a series of very brief sampling periods. The important difference is that in Scan Sampling, the observer records whatever the individual is doing during the sampling periods, rather than scoring an event as being absent or present. This method samples states and can be used to study behavioral synchrony in a group and the percent of time that individuals devote to various activities. Because the observer should be able to identify the individual's state instantaneously,

the behavioral categories should be clear and easily distinguished. Thus, the author recommends that this method be used in studies of non-social behavior, or in studies in which social behavior can be lumped into a few unambiguous categories.

h) Multiple Sampling. Often, several sampling methods can be used effectively in a single study. For example, one could record All-Occurrences-of-Some Behaviors for the group while sampling behavior of a focal individual.

4. Categories: A distinction is made between behaviors as events and behaviors as states. Events are instantaneous and considered at their onset or at any other instant. They are studied in order to answer questions about frequency of behaviors. States have "appreciable durations" and are studied in order to determine percentage of time spent at a given behavior. The author cautions that many comparisons that are discussed in terms of frequency are actually based on rates. Because individuals are seldom observed for exactly the same amount of time, a researcher, under these conditions, should base his or her statements on the frequency of a subject's behavior per unit time observed (rate).

Validity is defined as the condition in which there is a minimum number of plausible alternative hypotheses consistent with the data. Internal validity concerns statements about the sample, and external validity concerns generalizations from the sample to other situations or populations.

--Reviewed by Susan Frey

Source: Argyle, M. Non-verbal communication in human social interaction. In R. Hinde (Ed.), Non-verbal communication. Cambridge: Cambridge University Press, 1972.

1. Summary: This article reviews a number of research methods and results in the study of non-verbal communication. Argyle notes that non-verbal communication has been studied from a number of different orientations, including that of students of animal behavior (which has focused on cross-cultural and cross-species similarities in non-verbal communication), a structural-linguistic approach (seeking a syntax for non-verbal communication by treating it as a language of its own), sociological approaches (tending to look at differences in non-verbal communication in different social settings), and what Argyle calls a social psychological approach (looking at the functions of non-verbal communication in regulating interaction).

Argyle concludes that the functions of non-verbal communication (NVC) are to manage the immediate social situation, sustain verbal communication, and replace speech in conveying methods. The first use of NVC is similar to animal communication, which also regulates interaction and communicates attitudes and emotions, although there appears to be more variation in human NVC than in that of other animals. The use of NVC to support and complement verbal communication is only found in man (since verbal language is a human characteristic), and appears to be part of an overall system of communication, with complex rules of sequence and structure. NVC has also been used to develop gestural languages, as in some Australian aboriginal groups and in modern sign languages, although these uses are based on words despite being non-verbal in modality.

Argyle suggests that NVC in humans occurs primarily via the following channels: bodily contact (hitting, stroking, etc., with great cross-cultural variations in this form), proximity (with small but stable individual differences in preferred proximity, and much greater cross-cultural differences), orientation (the angle at which people stand or sit in relation to each other, which varies in different situations and with some cross-cultural variation), appearance (both those aspects that are under voluntary control, such as dress, and other less voluntary aspects of appearance), posture (which varies with emotional state and seems to be less well-controlled than facial appearance or voice, leading to "leakage" in Ekman's terms when a person is attempting to hide emotions), head-nods (which acts as a conversational reinforcer), facial expression (much of which appears to be culturally universal and largely independent of learning), gestures (primarily but not limited to hand movements, which communicate both emotional conditions, help control the synchronizing of utterances and illustrate what the speaker is saying), looking (which plays an important role in communicating interpersonal attitudes and conveying interest in the speaker and his message), and the non-verbal aspects of speech (which includes both prosodic sounds [pitch pattern, stress pattern, pauses and timing, which affect the meaning of utterances] and paralinguistic sounds [such as emotions expressed by tone of voice, accent, speech quality, errors in speaking, etc.]).

2. Major implications for a definition of teaching: Non-verbal communication would be involved with education in two distinct ways. First of all, NVC would be employed in the communication that occurs in classrooms, and would be a part of the educational process. Since a large part of NVC is culturally-determined rather than biologically determined and cross-culturally inflexible, school may be one place in which children learn their culture's rules for the use of non-verbal behaviors (e.g., telling children not to point).
3. Major implications for studying teaching: A number of the methods employed in studying NVC are applicable to the study of other kinds of interaction, including those which go on in classroom settings. Study of NVC has been undertaken from a number of different approaches. Social psychologists have developed the method of using well-controlled laboratory studies, which often occur on extremely artificial conditions and lead to only limited information about the use of NVC in actual situations. Studies of NVC have also been undertaken as field experiments, typically by having a stooge respond to an unsuspecting subject in some standard way (e.g., sitting at a particular distance from them on a park bench or asking for directions) and laboratory experiments have been undertaken which attempt to replicate real-life situations, either by setting up a social situation with which the subject should be familiar or by use of a standard confederate. Other researchers studying NVC have filmed or otherwise recorded actual interactions, then studied the interactions to define behavioral units, and finally performed contingency analyses to determine the likelihood of a particular response given a particular non-verbal behavior.
4. Categories: Argyle generally considers behavior that accompanies speech or occurs in situations in which verbal communication does or might take place as non-verbal communication, commenting that "speech is accompanied by an intricate set of vocal and gestural non-verbal signals, which affect meaning, emphasis, and other aspects of utterances."
5. The nine elements:
 1. Students: Students both emit and receive a larger number of non-verbal communication in the course of school, so both their non-verbal communicative behavior and their ability to comprehend the non-verbal communication acts of others are worth studying.
 2. Teachers: A teacher has at his or her command a repertoire of non-verbal behaviors which can be used in regulating classroom interaction and expressing his or her emotions and attitudes about students. Analysis of such teacher NVC could prove important to understand the success or lack thereof of a particular teacher.
 3. Other human elements: Not specifically relevant.

4. Role: NVC has as an important function establishing and expressing the relations between the communicators. Argyle describes a study in which subjects were as able to judge the dominance and confidence of a speaker when he was reading a set of numbers as when he was reading a statement about his feelings. Aspects of speech such as accent, loudness, speed and other kinds of self-presentation are important in establishing roles, and are important functions of NVC.

5. Time: Not relevant.

6. Place: Not relevant.

7. Task: Not relevant.

8. Standards and sanctions: Argyle suggests that much regulation of interaction occurs at a non-verbal level, thus, NVC probably functions to express evaluation of behavior and to apply mild sanctions to undesirable behavior.

9. Communication: Non-verbal communication is a large and significant aspect of the communication that occurs during teaching, in all the modes described above (bodily contact, proximity, orientation, appearance, posture, head-nodding, facial expression, gestures, looking, and non-verbal characteristics of speech). It is doubtless important to consider the NVC in classroom interaction in order to get the full "message."

--Reviewed by Kevin Miller

Source: Bakeman, R. Untangling streams of behavior: Sequential analysis of observational data. In G. Sackett (Ed.), Observing behavior (Vol. II): Data collection and analysis methods. Baltimore: University Park Press, 1978.

3. Major implications for studying teaching: Bakeman describes different types of data representations with their respective formats and types of analysis. It is assumed that behavioral units are discretely defined. The analyses that are discussed are based on conditional probabilities. They are especially suited to studies of social interactions.

There are four types of data representations as shown in the table.

	sequential	concurrent
event (frequency)	I	II
time (duration)	III	IV

Type I data note the order of events and are usually in the format of a sequence of symbols representing a behavioral code. They could be used in studies of classroom interaction. Sackett's probabilistic approach (lag sequential analysis) can be used to analyze Type I data. The strength of this approach is its ability to identify sequences that contain indefinite elements at specified lags.

Type II data are very difficult to collect and are used rarely, thus they are not further discussed in the chapter.

Type III data are usually in the form of a sequence of pairs of symbols: the behavioral code plus the number of intervals it lasted. A method using state transition diagrams can be used to analyze these data when a few mutually exclusive behaviors are under consideration-e.g., behaviors in interviews. Transition probabilities are calculated to describe the nature of interaction. For example, the following components describe the nature of interaction. For example, the following components of an interview could be examined: coaction, one individual acting alone, the other acting alone, or both individuals being quiescent.

Type IV data are flexible and can be used with a large number of behaviors. Their format is like that of an n-channel recorder with one channel per code. In order to assess concurrent patterns, one could get an index of whether behaviors coincide more or less frequently than their simple probabilities would predict. This index would consist of an observed conditional probability. One way to

Review of Bakeman (1978), pg. 2

determine significance is to use an arbitrary decision rule, for example, a Z-score. To examine causal directions of behavior, one could graph lagged conditional probabilities. Given two behaviors A and B, if A caused B and B did not cause A, then $p(B/A) > p(B)$ and $p(A/B) \cong p(A)$. If A caused B and B caused A, then both conditional probabilities would exceed the simple probabilities by approximately the same amount.

--Reviewed by Susan Frey

Source: Bekoff, M. The development of social interaction, play, and metacommunication in mammals: An ethological perspective. Quarterly Review of Biology, 1972, 47, 412-434.

1. Summary: Understanding the dynamics of the ontogeny of social behavior is of critical importance to evaluation of adult behavior, yet the attempt to analyze social interaction and social developmental processes in the young of a species in terms of adult characteristics and behaviors is misleading. A prime example of this is the study of play, which has frequently been defined in terms of adult characteristics, e.g., non-work or not serious.

Bekoff suggests that the proper way to investigate play behavior is to establish behavioral repertoires (or ethograms) for the organism in question (the young of a species). The behaviors involved should be relatively simple, observable, and measurable, although they can range in complexity from a muscle twitch to an entire pattern such as migration. Bekoff suggests that the proper level of initial analysis for social behavior is that of discrete motor action patterns.

Bekoff defines social play as "that behavior which is performed during social interactions in which there is a decrease in social distance between the interactants, and no evidence of social investigation or of agonistic (offensive or defensive) or passive-submissive behaviors on the part of the members of a dyad (triad, etc.), although these actions may occur as derived acts during play (Bekoff, 1972). In addition, there is a lability of the temporal sequence of action patterns, actions from various motivational contexts (e.g., sexual, antagonistic) being combined (e.g., Ludwig, 1965; Loizos, 1966; Ewer, 1968)." This definition demonstrates the importance of establishing an ethogram prior to commencing studying play, since otherwise it would be impossible to determine which behaviors do or do not serve a different function (such as agonism).

Bekoff suggests that play has as an important metacommunicative role, with the organism learning how to solicit and maintain "play" situations. He reviews primate and wolf studies suggesting that there are specific markers of play behavior which are essential to the maintenance of a play situation. Examples are the "play face" which has been described for both primate and wolf, which he asserts carry the metacommunicative message that "this is play." He suggests that the metacommunication which defines play be important in the organism acquiring metacommunicative ability in general, as one of the basic communicative skills that must be acquired for normal behavioral development and eventual competent performance during adult social interactions.

The communication necessary to play is also facilitated by the development of species-typical and ritualized play features, such as the "play face" mentioned above. Play also appears to be important to behavioral neoteny, the development of an extended dependent state of infancy in organisms such as wolves and primates. Bekoff suggests that

"the concept of behavioral neoteny is related to the whole of social ontogeny, in that animals that are born with a paucity of genetically fixed behavioral sequences require a period in which inborn motor action patterns become integrated and canalized into situation-specific contexts."

2. Major implications for definition of teaching: Human beings are viewed as an organism that is born prematurely, with infants requiring extensive experience before acquiring the characteristics of adult humans. The experience involves learning how to integrate inherited action patterns into more complex and automatic responses. A particular aspect of this learning is the development of communicative and metacommunicative skills, learning the proper contextual interpretation of different actions. Teaching is part of this process, since it has as an aim the development in young organisms of the behaviors and abilities required for effective adult performance.
3. Major implications for studying teaching: Bekoff stresses the importance of developing a descriptive ethogram of the possible behaviors that might occur in a situation prior to commencing specific observations of a particular class of behavior or experimental manipulations of behavior. This strategy is directly relevant to studying teaching, since it implies that the proper manner in which to study teaching is by developing a taxonomy of the kinds of behaviors that occur during teaching and learning, prior to investigating the effects of particular environmental and experiential variables on the kind of behavior that occurs.
4. Categories: Social play is defined as behavior that occurs during social interactions in which there is a decrease in social distance and no evidence of agonism, as well as a lability in the usual temporal sequence of action patterns, with combinations of action patterns from various motivational contexts frequently being seen together. Metacommunication is communication about communication, which establishes the context in which communication will occur and provides information relevant to the interpretation of a message. Behavioral neoteny involves the prolonged period of dependency on adults in some species, and the corresponding delayed personal responsibility of the infant for satisfaction of primary needs. This prolonged infant allows increased time in which to develop the necessary communicative and metacommunicative skills necessary for normal social development.
5. The nine elements:
 1. Student: Students, as young human beings, are characterized by a high degree of dependence on adults for the necessities of their lives. This dependency frees them to devote extensive time and effort to such activities as play and learning, which allow them to develop the communicative and metacommunicative skills (as well as other skills) that are essential for effective adult performance in satisfying basic needs and producing viable offspring. The "openness" that this behavioral neoteny is related to permits a correspondingly large degree of cultural influences on the course of development. 43

2. Teachers: Teachers play an important role in shaping the course of development in order to ensure that students develop the behaviors and skills that are essential to their later adaptation to adult life.

3. Other human elements: Not specifically relevant.

4. Role: Role-learning can be an example of the kind of learning that children must acquire during their period of dependency. The information that children acquire when they play at being in various social and occupational positions may thus have implications for their understanding of how society functions, and be an example of the role of play in the acquisition of adult behavior patterns.

5. Time: Not specifically relevant.

6. Place: Not specifically relevant.

7. Task: It is suggested that play serves a function, and that the task of play is the development of information about the contextual variations of information, and practice of skills that will be useful in later life, when the long period of human dependency is ended.

8. Standards and sanctions: Another role suggested for play is the development of standards for certain kinds of behavior. Wolves, for example, appear to learn how to control the force of their bites in the course of play with other wolves. Among human beings it is likely that standards for behavior emanate in part from social experience in playful interactions.

9. Communication: The contextual variations in the message communicated by a particular communicative act are emphasized in this article, with the suggestion that an important communicative skill acquired during neotony is facility with metacommunication, understanding the signals that establish the context of message and affect its interpretation. Play is an example in itself, since children must learn the metacommunicative signals that establish a situation as a playful one.

--Reviewed by Kevin Miller

Source: Blurton-Jones, N. Non-verbal communication in children. In R. Hinde (Ed.), Non-verbal communication. Cambridge: Cambridge University Press, 1972.

1. Summary: Blurton-Jones notes that there are at least two different "meanings" of a facial expression, with one being the cause of the expression and the other being the effects of the expression on other persons in the environment. A majority of previous studies have examined the ability of standard situations to elicit specific facial expressions, while Blurton-Jones emphasizes the importance of naturalistic observation of facial expression in determining the function of facial expressions in on-going social interaction.

Blurton-Jones notes that little is known about facial expression during the one to two year age period, although there is increasing evidence of the effectiveness of non-verbal communication (NVC) on the part of children of this age in regulating social interaction. Blurton-Jones suggests that the repertoire of facial expressions and noises in children of this age is comparably complete, although it remains to be determined how the functions of various expressions change with age, if they do.

Studies of non-verbal communication in children from two to five years of age have been conducted by a number of investigators. Most studies have focused on elicitors of NVC expressions, although there are an increasing number of studies of the function of NVC in this age period. As an example, Blurton-Jones refers to a study of his showing that the arm-raised posture that children direct towards their mothers leads to a high probability of the mother touching the child. Studies of crying have shown large age and sex differences in the frequency of crying in particular situations, with crying becoming much more common in social situations than non-social situations with age. Smiling appears to have important functions in social situations, and often appears to be unreciprocal in children of this age, with children low in a dominance-hierarchy more likely to smile when initiating interaction with higher-ranked children than vice versa. Blurton-Jones notes that studies of smiling have been limited by the assumption that smiling is a unitary behavior, and suggests that further progress in this area awaits the refinement of taxonomies of types of smiles (e.g., simple smile, upper smile and broad smile, as described in the review of Brannigan and Humphries, 1972). Similar taxonomies of facial expressions related to aggressive interactions are essential for further understanding of NVC in aggressive and threatening situations.

A number of areas of NVC have been largely neglected in studies of children's NVC. NVC by sound has been largely neglected, despite the fact that it is commonly believed that the babbling of children is importantly related to language development. Communication by physical structures has also been largely ignored, with the exception of studies of Konrad Lorenz's belief that there are physical characteristics of "babyhood" (e.g., large cranium to face proportions) which are elicitors for parental care. Communication by odors has also been ignored, despite the fact that the strong feelings that odors elicit suggest that this

may be an important modality for NVC. NVC from adults to children has also been largely neglected, although there have been some findings in this area. An example is the high-pitched voice that adults adopt when talking to children, and the finding that both adults and older children are liable to bend at the waist, sometimes to kneel or crouch down, and to hold the head to one side, and/or wave the head slowly from side to side when talking with younger children.

2. Major implications for a definition of teaching: Teaching must be defined in such a way as to include the communication that occurs via non-verbal channels, since these channels are generally important in interaction.
3. Major implications for studying teaching: The method used by Blurton-Jones could well be applied to studying teaching. This method involves observation of behavior in natural settings, leading to the development of behavioral categories capable of reliable observation, then the use of these categories to observe on-going interaction. Information concerning the causes and functions of behavior is then gathered by correlational analysis (including factor analysis) of the sequential relations between various actions.
4. Categories: Blurton-Jones notes the importance of developing categories that are defined in terms of motor patterns, and emphasizes the importance of precise definition of such behavior. As an example, he notes that earlier studies of smiling often led to contradictory findings on the role of smiling as NVC, which he largely attributes to their failure to adequately define the different kinds of smiling, treating it instead as a unitary behavior.
5. The nine elements:
 1. Students: Students are human beings who are capable of using a large repertoire of NVC behaviors to express feelings and attitudes and to regulate social interaction.
 2. Teachers: Teachers are also human beings with a wide (possibly wider than that of their students) repertoire of NVC behaviors.
 3. Other human elements: Not specifically relevant.
 4. Role: Role probably effects the kinds of NVC used and the manner in which it is used. As an example, Blurton-Jones describes his finding that children of low status in a playground are much more likely to smile when initiating interaction with children of higher status than are children of high status when initiating interaction with lower status children.
 5. Time: Not specifically relevant.
 6. Place: The place in which NVC occurs may have an important effect on the NVC that takes place, particularly in terms of territory defined as belonging to one of the interactors in some way.

7. Task: Not specifically relevant.

8. Standards and sanctions: NVC may well be used to express approval or disapproval of behavior, thus functioning as a subtle means of administering sanctions and communicating standards.

9. Communication: This article discusses the importance of non-verbal channels of communication in the behavior of even young children. It also describes two different ways of studying such communication, one emphasizing the stimulus situations that elicit particular expressions (and thus being amenable to laboratory studies), the other focusing on the use of NVC to regulate interaction in on-going social situations. He suggests that the second, or functional approach is probably more appropriate as a method of beginning study of NVC. This argument should be equally applicable to other kinds and modes of communication, as well as interaction in general.

--Reviewed by Kevin Miller

Source: Blurton-Jones, N. and Konner, M. Sex differences in behaviour of London and Bushman children. In R. Michael and J. Crooks (Eds.), Comparative ecology and behaviour of primates. New York: Academic Press, 1973.

1. Summary: The authors note that previous studies of sex differences in behavior tended to consider only attitudes or behavior in experimentally-controlled situations, and were largely limited only to European and North American cultures. They looked at differences in the frequency of occurrence of naturally-occurring behaviors as a function of culture and sex, comparing the behavior of Kung Bushmen and London children 3-6 years of age in natural playgroups.

Konner and Blurton-Jones concluded that a number of the sex differences commonly found in studies of children are also evident in an extremely different society, while equally common sex differences appeared only in their London sample. Sex differences in agonistic behavior, rough and tumble play, preference in interaction to adults as opposed to children, and interaction with adults other than the mother were found in both cultures. At the same time, they found sex differences only in the London sample in general activity, amount of play with objects, sustained attention and preference (of boys) for playing with boys. These findings support the contention that innate behavioral sex differences are not so great as they appear when research is limited to North American and European samples. Blurton-Jones and Konner believe that their results support the belief that there are some sex differences which may ultimately be traced to hormonal sex-typing of parts of the brain. The authors conclude that their findings "could be taken as justification for those who argue that our culture makes girls unnaturally well-behaved and other than they might be."

2. Major implications for a definition of teaching: The article suggests that there are probably innate sex-related differences in behavior, which a theory of teaching must taken into account. On the other hand, it suggests that these innate differences are more circumscribed in extent than they appear to be in our culture.
3. Major implications for studying teaching: The authors employed observational categories previously developed for describing the social behavior of young children (see Blurton-Jones reference under III.A. on the annotated bibliography for actual categories). The emphasis was on recording the occurrence of "small, easy to describe items of behavior" as they occur in natural settings. Data from these observations was combined into categories suggested by factor-analysis of previous observations collected using this system, creating the categories such as "agonism" on which data is reported.
4. Categories: Behavioral categories are given in the Blurton-Jones (1972) article in the annotated bibliography (section III.A.).

5. The nine elements:

1. Students: Sex differences in the behavior of young children may be reliably observed in cultures as vastly different as London and the !Kung Bushmen of the Kalihari desert. This suggests that sex differences are probably a "fact of life," to be taken into account in describing students and theorizing about them. There are also important sex differences in behavior which may be reliably observed within a single culture, and it is a mistake to equate these differences with the smaller set of potentially universal sex differences. This type of sex difference also must be taken into account in describing the students within a particular culture, and the article suggests that it is important to try to distinguish which kind of sex difference is being referred to.

2. Teachers: The article considers child behavior primarily, but the argument made above (#5.1) could probably be directly applied to adults.

3. Other human elements: Not specifically relevant, other than the general point about the limited ubiquity of sex differences.

4. Role: The support the article provides for the fundamental nature of behavioral sex differences suggests that some sexual dimorphism of roles may result from these differences, as the authors suggest. Their findings suggest that males may be more generally suited to aggressive roles, although they believe that London society emphasizes and exaggerates these differences, concluding that "the evidence strongly supports the idea that our own culture (like all cultures) burdens children with a great deal of sex role paraphernalia that goes well beyond the dictates of biology."

5. Time: Not relevant.

6. Place: Not relevant.

7. Task: The authors cite prior work suggesting that boys are more likely to direct sustained attention towards objects than are girls; they found this difference in their London sample but failed to find it in their Bushmen sample.

8. Standards and sanctions: Standards of sex role behavior are frequently attributed to parental application of sanctions to shape the behavior of their offspring into sex-role-appropriate channels. The article provides moderate support for this view, while insisting that there are likely to be important sex-role differences that will persist in the absence of differential socialization of sex-roles.

9. Communication: The study found that girls in both cultures were more likely than boys to interact with adults (with interaction being primarily verbal and NVC). Sex differences in peers interacted with were found in the London sample (as is typical), showing that boys were

more likely to interact with other boys than girls; this sex difference was not found in the Bushmen sample.

6. Description of study:

a) Behavior: (cf. #3 above)

b) Setting: All observations occurred outdoors, in the company of children well known to the subject, and with the mother available to the child. In the Bushmen study all observations took place in the village proper.

c) Treatment: None

d) Data collection: (cf. #3 above). The behavioral categories were ones that could be reliably observed in prior studies, and were simple behaviors (e.g., "hit," "kick," "chase"), non-verbal expressions, and information about location with respect to other persons.

e) Data analysis: The preliminary nature of the data analysis is emphasized repeatedly. Data collected was gathered into major clusters such as "rough and tumble play," "agonistic behaviors," as well as categories reflecting persons interacted with and object use. These factors came from Blurton-Jones' (1973, see III.A on the outline) factor analysis of observations on English children using this same observational system.

--Reviewed by Kevin Miller

Source: Brannigan, C. and Humphries, D. Human non-verbal behavior, a means of communication. In N. Blurton Jones, (Ed.), Ethological studies of child behavior. London: Cambridge University Press, 1972.

1. Summary: Facial expression and other non-verbal communication (NVC) behavior have been the subject of earlier experimental research, but much of this research has suffered from inadequate description of the expressive patterns themselves and insufficient attention to the natural circumstances in which such patterns are normally shown. This article is part of a recent ethological line of research in human NVC which focuses on the descriptive analysis of behavior in "natural situations" such as children's play-groups.

The authors define communication by saying that "communication occurs when certain attributes of an individual (usually behavioral attributes) appearing in specific situations are, via their effect on the sense organs of another individual, capable of altering that individual's future behavior." The importance of non-verbal modes of communication in the behavior of young children is evidenced by their findings that 3- and 4-year-old children use speech fairly freely to communicate with adults; they use it infrequently among themselves during group play, relying instead on gestures, facial expressions and intention movements to integrate their activities.

Descriptive studies of NVC raise a number of problems of definition and categorization, which are made more severe because behavior can be described on a number of different levels. The authors discriminate phenomenological criteria (lumping behavior according to the form it takes), functional criteria (all items which serve the same kind of consequence are put together), situational criteria (grouping all items which occur in the same situation) and causal criteria (items sharing common causal factors are grouped). Among these criteria, however, the authors emphasize the importance of phenomenological units as a proper starting point, with initial description based on the form of behavior permitting later analyses of function and cause, with eventual experimental work refining conceptions of the causes and functions of specific behaviors.

The authors emphasize the agreement that has been obtained on units defined in independent studies of human NVC, although differences have appeared due primarily to the level of analysis being used, with large units in one study frequently being broken down into constituent categories in other studies. They suggest that a proper level of analysis and categories will vary with the function of the study and the facilities available.

The study of human NVC is made both easier and more difficult by the fact that the observers are members of the same species as the subjects. The observer's subjective reaction often indicates whether or not a behavior has signal value, but it is at the same time exceedingly difficult to become sufficiently detached and objective to gather clear objective evidence documenting this signal value. It is hard to avoid the common pitfalls of popular misconceptions about NVC and popular modes of thinking

about human behavior. For example, the use of single words such as "smile" or "frown" in popular usage to describe a number of quite distinct patterns has prejudiced a number of prior observers into not making the necessary separate definitions.

The authors note that the vast majority of human facial expressions are bilaterally symmetrical, despite the fact that variations in symmetry could conceivably provide a rich source of potential for subtle modification of signal value. They suggest that this would be at the cost of misinterpretation when social partners are not directly facing each other, and supplies redundancy which is augmented by partial duplication of signal value in different expressive regions.

Demonstration of important pan-cultural factors in the forms and recognition of facial signalling further suggest that research on the development of expression from birth onwards is needed to reveal the ways in which learning may influence the forms, usage and recognition of expressions. They note the importance of NVC in understanding motivation in cases in which a person is attempting to project a false message at a verbal level, a concept referred to by Ekman as "leakage." They note Freud's (1905) remark on this subject that when a person is attempting to project a false front "if his lips are silent, he chatters with his finger-tips; betrayal oozes out of every pore."

2. Major implications for a definition of teaching: One of the modalities by which teaching takes place is NVC, and this modality may serve to convey important information concerning attitudes and feelings of teachers and students towards each other, particularly in cases where such attitudes cannot be consciously acknowledged or expressed. Further, learning concerning the appropriateness of particular NVC behaviors in particular situations may well occur in school settings.
3. Major implications for studying teaching: The distinction between phenomenological (form), functional (consequences), situational (setting), and causal (common causal factors) analysis is applicable to the study of behavior that occurs in teaching situations, as well as the belief that phenomenological descriptive analysis is the proper place to begin the study of behavior. It may well be necessary to begin with a more general analysis of behavior in a classroom setting than that of the authors (they define 136 categories of NVC behaviors, consisting of a number of units in the mouth region, eyebrow, eyelids and eye surroundings, gaze direction, other facial units, head movement, hand and arms, lower limb units, and trunk units).
4. Categories and definitions: Communication is defined as attributes or behavior of one individual that appear in specific situations and are capable of altering the behavior of another individual through that person's perception of the behavior or attributes. The taxonomy of NVC behaviors is too extensive to describe here in its entirety, but the authors distinguish

between 10 kinds of smiles, with these definitions:

1. Simple smile: lips together but not compressed, drawn up and out at the corners.
2. Upper smile: The mouth corners are drawn up and out, remaining pointed, the lips parting to reveal some of the upper set of teeth, but not the lower.
3. Broad smile: Similar to upper smile, but the lower lip is pulled down to reveal some of the lower teeth.
4. Compressed smile: As simple smile, but lips compressed and tending to be turned slightly into the mouth.
5. Wry smile: An asymmetrical smile in which the lips remain closed. One side of the face adopts the form seen in a mouth corners down while the other side adopts the form seen in a grin or in a simple smile.
6. Oblong smile: Lower jaw pushed out so that the incisor teeth are directly opposed and usually in contact, both upper and lower sets being exposed, and the mouth corners are drawn up and out tending to be rounded not pointed.
7. Lip-in smile: Similar to upper smile, with the lower lip drawn in between the teeth but not bitten.
8. Play face: The mouth is widely opened as in open mouth, and the mouth corners tend to move out and up, producing the pointed appearance characteristics of smiles. The teeth are mainly or entirely hidden by the lips.
9. Grin: As simple smile, but involving one side of the mouth only.
10. Open grin: General appearance rather as in upper smile, but instead of being passively lifted from the mouth corners the top lip is actively raised as in sneer and is slightly out-turned. Often on one side only, but may be symmetrical.

5. The nine elements:

1. Students: Students are seen as persons who have at their command a vast array of NVC behaviors. Younger students may resemble the three and four year olds observed by the authors in having a preference (as compared to adults) towards relying on NVC at the expense of words in regulating social interaction among themselves.
2. Teachers: Teachers are also seen as being effective at sending and receiving NVC signals. NVC may also be important in understanding teacher behavior because of the principle of "leakage," the sending of NVC signals in cases in which the person is overtly attempting to dissemble by transmitting a false signal. Since teachers can be

expected to be under some social pressure to transmit signals that may well be false (e.g., like all of their students), NVC may provide information betraying their true feelings, which students may or may not be capable of picking up.

3. Other human elements: Not specifically relevant.

4. Role: Role may be a determinant of the kinds of NVC messages which are transmitted. Role may also be important in establishing role-expectations which may not conform to reality, thus creating a need for dissembling and the possibility of NVC "Leakage" transmitting a message contract to that sent through verbal channels.

5. Time: Not specifically relevant.

6. Place: Not specifically relevant.

7. Task: Not specifically relevant.

8. Standards and sanctions: Since humans possess an extensive NVC channel, NVC may play an important role in establishing (or undercutting) standards, providing subtle sanctions (e.g., frowns) for the breaking of standard expectations.

9. Communication: Non-verbal communication constitutes an important channel of communication, and the authors suggest that for young children it may constitute a preferred channel. The concept of "leakage" also suggests that "communication" may not constitute a single message, but that verbal channels of communication may often express a message which is contradicted by non-verbal channels. This principle also holds for different kinds of non-verbal communication, with falsified upper smiles generally not being accompanied by the relevant changes in the eye region, and falsified crying not being associated with the ordinary position of the eyebrows.

--Reviewed by Kevin Miller

Source: Charlesworth, W. Human intelligence as adaptation: An ethological approach. In Resnick, L. (Ed.), The nature of intelligence. Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1976.

1. Summary: Ethology is defined as the study of the habits and characteristics of animals in their natural habitats from an evolutionary viewpoint, and an attempt is made to apply this approach to the phenomenon of human intelligence. Intelligent behavior is defined as adaptation of an organism to unusual, atypical or unexpected demands made by the environment.

Human intelligence must be understood in terms of both the historical phylogenetic developments leading to human intelligence as a species characteristic, and to the more immediate environment that the individual faces, which will tend to elicit certain kinds of intelligent behavior and not others.

Psychometric approaches to the study of intelligence are criticized for ignoring both of the above factors. It has particularly failed to show meaningful relations between intelligence tests and "life success", such that "one hundred years of intelligence testing have, at best, been only moderately successful in developing methods for effectively measuring the individual's ability to cope with life's problems."

An ethological approach to the study of intelligence involves the assumption that the organism is already more or less well-adapted to its environment. Observation of the organism in the environment to which it is adapted is essential to a full understanding of the specifics of that adaptation. Intelligent behavior is interpreted in terms of both phylogenetic (historical) and comparative (cross-species) information concerning methods of adaptation to different environmental demands. An attempt should be made to identify the cognitive structures which underlie the construction of human and lower primate artifacts and social structures which have had survival value. The belief that the consequence of intelligent behavior is increased viability suggests that it is worthwhile to study individuals who fail to reach reproductive age or to reproduce, since an ethological orientation suggests that this failure might be a useful indicator of lack or inadequate use of cognitive processes normally associated with intelligence.

2. Major implications for a definition of teaching: The goal of teaching can be seen as increasing the ability of the taught person to make intelligent behaviors, that is, to respond adaptively to unexpected situations as well as to familiar ones. This definition in turn raises a number of problems: What is the environment to which the student will be required to adapt, and what demands will it make on him or her? What kinds of behaviors will prove adaptive in that environment?
3. Major implications for studying teaching: The method of naturalistic observation is suggested as an approach useful to studying the questions raised above (#2). Observing how persons adapt to the environments they face during the course of their life could provide information concerning the skills that should be taught in schools, and the kinds of behaviors that are only adaptive in a school environment.

4. Categories: (cf. #1 above, and #6 below).

5. The nine elements:

1. Students: The student is seen as an animal who is likely to be programmed by his or her genetic inheritance to be receptive to learning the kinds of skills that will prove adaptive in later life, to the extent that the need for those skills has been a recurring need during human evolutionary history. The student exists in a particular, specific environment, and is assumed to be more or less adapted to that environment, while teaching represents an attempt to provide him or her with the skills necessary to adaptation in likely future environments.

2. Teachers: Teachers, as well as students, are seen as being more or less adapted to the environment in which they exist, and as attempting to maximize their adaptation to that environment. The approach described in the article would suggest that in order to understand the behavior of teachers in classrooms one should consider the extent to which "teachers" have existed during man's evolutionary history, by reference to cross-species comparative data and to reconstructions of human phylogenetic development. Naturalistic observation of teachers in classrooms should also help to elicit the extent to which the behavior of teachers can be understood in terms of adaptations to specific characteristics of the environments in which they work, and to what extent they can be attributed to general characteristics of human beings in a teaching situation.

3. Other human elements: Not specifically discussed, although the approach described would suggest that such persons should include persons such as future employers, etc., who may have no direct effect on the current environment of the schoolroom, but who phenomenologically or practically affect the future environment in which the students will have to apply the intelligent and adaptive skills developed in school.

4. Role: Roles are discussed only indirectly in this article, through discussion of the role that cognitive development plays in understanding the role relations in a dominance hierarchy. To the extent that human beings interact with each other in terms of the roles that they have taken on, and to the extent that it is adaptive to be able to determine someone else's social role, then a child's developing intellectual abilities should be used in determining the roles of others. (See review of article by Edelman & Omark, 1973, for more specific discussion of this point.

5. Time: Time is not specifically discussed in this article, although the point is stressed that in order to understand intelligence it is essential to understand that each organism has both a phylogenetic

(species) and ontogenetic (individual) developmental history, and an individual's behavior at any particular point in time is seen as a combination of genetic factors (expressing the evolutionary history of the species, along with some idiosyncratic characteristics), and an individual developmental history.

6. Place: This element is discussed in terms of assessment of intelligent behavior. The point is made that this assessment must be made and evaluated in terms of the particular environment to which the individual and the species to which it belongs have adapted. By implication, teaching settings should be similar to the settings in which later adaptation will occur, such that behaviors that are adaptive in the one setting will also prove to be adaptive in the other, sparing the individual the necessity of having to "unlearn" previously adaptive behavior.

7. Task: An environment presents an individual with certain problems, to which the individual responds behaviorally. This behavior may represent routine behavior patterns in response to predictable characteristics of the environment, intelligent responses to unexpected aspects of the environment which require the individual to make adaptations to them, or species-general behaviors that are responses to the adaptational requirements faced by many members of the species throughout its evolutionary history.

8. Standards and sanctions: Standards and sanctions are not discussed in this article.

9. Communication: Communication is not discussed specifically in this article, although it may be defined similarly to teaching (i.e., #2 above), as behavior on the part of one organism that affects the behavior of another to the adaptive benefit of both.

6. The article discusses a study (See Charlesworth & Spiker, 1975, in bibliography) of the problem-solving of young children.

a) Behavior: The study was a naturalistic observational study of the responses of 4 toddlers to problems that occurred naturally in their homes. Problems were defined as interactions that led initially to blocking of ongoing behavior. Problems were recorded whenever they were observed by the observer while watching a single child in his or her home.

b) Setting: Observations took place in the home (although the same method has been employed in a preschool classroom by Spiker, 1974).

c) Treatment: (cf. 6a above)

d) Data collection. The observer made on-the-minute observations of ongoing behavior in the child, in addition to the problem observations. Whenever a problem occurred, the observer wrote a narrative account of the episode, noting the prior setting, the child's behavior prior to the problematic block to this behavior, the exact nature of the block, the sequence of behaviors in response to the block, including the behavior of other persons if involved, and the child's behavior following the solution or non-solution of the problem, along with a time estimate of the problem episode.

From this initial observational method, a taxonomy of problems was developed for future observations, consisting of a 2 x 6 grid of types of problems: observed impositions or observed/inferred needs or wants, versus social, physical or cognitive problems. (A more sophisticated version of this method was employed in the study by Charlesworth, Kjergaard, Fausch, Daniels, Binger and Spiker, 1976; see bibliography).

e) Data analysis: After the taxonomic categories were developed, percentages of various types of problems, and percentages of time spent in problem episodes were calculated.

--Reviewed by Kevin Miller

Source: Charlesworth, W. and Bart, W. Some contributions of ethology for education. Educational Studies, 1976, 7, 258-72.

1. Summary: The article discusses ways in which an ethological approach to studying education can help relate educational practice to human biological characteristics and to everyday problems of human adaptation. Education is seen as one of the means whereby human beings adapt to their environment, and as such it can be understood in terms of the increased survival value conferred on educated persons. The use of phylogenetic comparisons should also increase an understanding of the adaptive role of education, through comparing the practice and function of education in humans with that of other primates. Looking at education in terms of a distinction between phylogenetic and ontogenetic contributions to adaptation should foster understanding of the ways in which species characteristics ensure that the young organism is ready to learn certain types of behaviors at certain periods in its development.

Ethology can also contribute to the methodology of educational research. These contributions would be primarily in terms of the use of observation of behavior in its natural settings to achieve an understanding of the kinds of adaptational skills that the organism must acquire (seen as the goal of education), and the use of the same methods to study the educational process.

2. Major implications for a definition of teaching: Teaching would be defined as those behaviors shown by one organism which have the effect of modifying the previous behavior patterns of another organism in such a way as to increase the likelihood that this (second) organism will produce viable offspring. Thus, instruction is any behavior that leads to an adaptive modification of the behavior patterns of another organism.

Primary implications of such a definition are that teaching need not be restricted to formal, or even verbal instruction. It need not be restricted to a classroom setting, and the above definition suggests that most teaching probably occurs outside the confines of schools.

3. Major implications for studying teaching: The article discusses the use of naturalistic observation in education. Characteristics of this approach would be: 1) observation in educational settings to develop an observational taxonomy which would structure further observations, to determine what actually happens in classrooms, 2) a similar observation of the settings in which the results of education are applied, such as job performance, and, 3) integration of the first two to determine "what education for persons in the real world is about and what function it actually serves."

4. Categories and definitions: (cf. #1 above)

5. The nine elements:

- 1) Student characteristics: Ethology emphasizes the importance of phylogenetic characteristics shared by all members of a particular

species in determining behavior. For human children, the suggestion is that they tend to be ready to learn certain things at certain ages and not to learn certain other things, and that such innate predispositions to learn are aspects of human nature (although ones that currently are very poorly specified.)

Further, the broad definition of education implies that much of a student's education will occur before he or she enters school. From the point of view of possessing skills necessary to later adaptation, an individual is usually a very well-educated person by the time he or she formally becomes a student.

Finally, individual differences are seen as a fundamental characteristic of all groups of organisms, providing the variation that is the basis for natural selection. Educators must accept individual differences as a fundamental fact of life, and not as simply related to variations in previous environments.

(2) Teacher: The article does not specifically discuss teacher characteristics, but by extension it would stress acceptance of individual variations in teacher characteristics, the role that being a teacher may play in the teacher's adaptation (e.g., as paid employment) and the extent to which teacher-student relationships may involve innate mechanisms evolved to regulate adult-juvenile relationships in human societies during the course of evolution.

(3) Other human elements: The article does not discuss other human elements in formal education.

(4) Role: Not discussed.

(5) Time: Time is important in terms of ontogenetic chronology. The article suggests that there are "critical periods" in human learning analogous to the critical periods that ethologists have observed, for example, in studying the formation of social attachments in waterfowl. The suggestion is made that the sequence and timing with which learning occurs is not biologically arbitrary.

(6) Place: The article refers to a study by Peter Smith (1974: see review of that article) showing that variation in physical space and available resources had an effect on levels of aggressions in 2 preschool playgroups. The authors conclude that "we need to know to what conditions in the schools children can adapt and those which make adaptation difficult or impossible...some schools are unlivable or suboptimal because of crowded, depressing or threatening conditions." The classroom constitutes an environment to which children must adapt, and it must be evaluated in terms of its similarity and usefulness with respect to the later environments they will be faced with.

7) Task: Specific tasks are not discussed, although the main task of education (as of all behavior) is seen by ethologists as being to maintain and increase the adaptive viability of those involved.

8) Standards and sanctions: The article does not discuss existing standards and sanctions, although it does state that a meaningful standard for the evaluation of educational programs is their contribution to the development of adaptive skills relevant to present and future environments.

9) Communication: Communication is not discussed in this article.

--Reviewed by Kevin Miller

Source: Charlesworth, W., and Spiker, D. An ethological approach to observation in learning settings. In R. Weinberg and F. Wood (Eds.), Observation of pupils and teachers in mainstream and special education settings: Alternative strategies. Minneapolis: University of Minnesota Leadership Training Institute, 1975.

1. Summary: Ethologists are recognizable by their emphasis on the following five characteristics in their study of the behavior of organisms:

- a) An emphasis on observing and describing behavior in natural habitats;
- b) A concern for the function of behavior in terms of its adaptive significance in relation to an animal's particular ecological niche;
- c) A concern for the phylogenetic history of a species;
- d) A concern for the comparative status of a species' behavior in relation to other existing species; and
- e) A concern for the neuro-physiological mechanisms that immediately and directly cause and control behavior.

These characteristics are unified by a foundation consisting of the synthetic theory of evolution.

Human ethology is a relatively recent endeavor, despite Darwin's (1872) early use of ethological methods to study human facial expressions. Human ethology as a discipline has only existed for approximately ten years.

Ethologists have yet to investigate educational processes extensively, although it is possible to discuss education in terms of ethological conceptions and the information that does exist from ethological studies of human and animal behavior. Konrad Lorenz (1969) has suggested that the adaptive specialty of primates, particularly of apes and humans, is being unspecialized, and having the ability to learn a wide, fairly unspecified range of different modes of adaptive behavior. This specialization in an ability to learn in turn necessitates the opportunity to learn in a setting protected from interruption and damage, thus leading to a period of infantile dependence on the older generation.

Education that occurs in nonhuman species is primarily a matter of imitation of adults by the young of the species. Since the longevity of adults is a reasonably good indicator of their adaptation to the environment, this is a relatively successful method of education. Some kinds of actual teaching exist, with an example being the practice of mother cats bringing their children dead and later wounded prey on which to practice killing; such examples are relatively rare, however.

An ethological view of education has at least two main theoretical points:

- 1) The function of education is to provide the young and naive individual with adequate means to adapt once he is away from the protection and support of the adult generation.
- 2) Education must begin with the genetically-given characteristics of the species, and the particular predispositions to learn particular patterns that the organism has inherited. Thus, the student is an active partner in the educational process, and can be viewed as being programmed to learn certain kinds of evolutionarily essential skills with comparative ease.

The authors focused on problem-solving as an area of behavior to study in preschool children, defining problems with reference to observable blocks in the ongoing behavior of children in a nursery school program, and gathering information concerning the source of the block, the nature and success of the child's success in solving the problem, and the consequences of the child's action.

2. Major implications for a definition of teaching: Teaching begins with the innate characteristics of the organism being taught. Human beings may be characterized by a high readiness to be taught relatively unlimited kinds of information, since this readiness to learn may constitute a distinctive human adaptation. The kind of information that human beings would have evolved to learn is that which improves the likelihood of current and later adaptation to the requirements of living and producing viable offspring. Thus, the evolutionary function of education as a human adaptation is to ensure the survival of the human species by means of providing information and skills necessary to later adaptation. Such education is a mutual process, with both students and adults having made adaptations that increase the likelihood of success of the educational process.
3. Major implications for studying teaching: Since only the actual behavior of an organism has direct evolutionary significance, an ethological approach to the study of education emphasizes the study of actual behavior (as opposed to questionnaire information or responses to standard but contrived situations) in natural settings, searching for the adaptive function of that behavior in conferring an increased likelihood of producing viable offspring on the persons in that setting. The units of behavior should be as precise, unambiguous, or low-inferential as possible, with broader meaning gathered through association with other such units.
4. Categories: A problem was defined as a situation that produces an observable change in a child's behavior. Such a situation arises either because the child's ongoing behavior is blocked or because he or she is experiencing the spontaneous expression of a need and has

no immediate way to gratify it. Blocks may be social (as in another person who interrupts a behavior) or object related (as in some object falling). Needs are inferred from the situation and may be physical (e.g., hunger), emotional (e.g., fear) or cognitive (wanting to know something). Thus a problem is a relational concept signifying a mismatch or disequilibrium in the relation between the child and his or her environment.

5. The nine elements:

1. Students: The student is a young human being, and as such is an organism that has species-characteristics predisposing it to learn information and acquire skills of a fairly general sort (compared to other species). Thus children should be receptive to learning the kinds of skills that will prove adaptive in later life, more so to the extent that the need for those skills has been a recurring one during the course of human evolution. The student is seen as being more or less adapted to his current environment, and is trying simultaneously to maintain and maximize his adaptation to both his current and his future environments.
2. Teachers: Teachers as well as students are seen as being more or less adapted to the environment in which they live, and as attempting to maintain and maximize their adaptation to that environment. Teachers may come with innate predispositions to teach particular kinds of things, as well as to learn particular kinds of things about their students, although this largely remains to be demonstrated.
3. Other human elements: Not specifically relevant.
4. Role: Not specifically relevant.
5. Time: Not specifically relevant.
6. Place: The authors suggest that human beings adapt to specific environments, and, accordingly, the adaptiveness of a particular piece of human behavior cannot be assessed in the absence of information concerning the particular environments to which the person has adapted.
7. Task: All persons involved in an educational system have two basic tasks. One is to maintain and increase their adaptation to the current situation they are in, and the other is to ensure that they will be adapted to future conditions. Teaching may be largely viewed as a process of information transmission aimed at equipping the young with the information and skills that will be required for later adaptation. The problem of education may then be the lack of information on the kinds of skills that are essential to such adaptation to future environments.

8. Standards and sanctions: This is not specifically described, although the ethological view described would suggest that there may be a biological standard (adaptation) by which learning may be judged, and a biological sanction against failure to adapt (disappearance of particular genes from the gene pool), with teaching being heavily implicated in human adaptation.

9. Communication: Communication may be defined as behavior on the part of one organism that leads to changes in the behavior of another organism, although it is not specifically discussed in this article.

6. Description of the study:

a) Behavior: The behavior was the natural behavior of six children in a preschool, recorded via on-the-minute sampling of the on-going behavior of children coupled with standardized narrative recording of problem-solving episodes. Behavior of persons other (including the teacher) than the particular subject being observed at that moment was recorded insofar as it affected the subject. (See definition of problems, #4 above).

b) Setting: The setting was a nursery school. Information was further collected on the specific setting of each observation, focusing on the location in which the behavior occurred, any persons located within three feet of the child, and objects with which the child was dealing.

c) Treatment: No experimental manipulation was employed.

d) Data sources and collection methods: The source of data was the ongoing behavior of the children being studied. Data collection was a mixed time-sampling and focal behavior method. On-the-minute samples were taken of the ongoing behavior and contexts of the children, and standardized recordings were made of problem-solving episodes involving any of the 6 children, as they occurred. The non-problem-solving behaviors were also classified into one of the following 11 behavior categories: playing (free or group), interacting socially, contacting objects, body-caring, self-stimulating, toileting, active looking, locomoting to goal, idling (standing, sitting, lying, walking), dressing, and eating.

e) Data analysis: Only a rudimentary analysis of the data is reported in this article, focusing on the origin of problems (43% resulted from interactions with objects in the environment and 57% from interactions with people in the environment), the total percentage of problem-solving behavior (an average of 5% of the nursery school day, with a range from 2-7% for individual children), and how the problems were solved (60% solved by the child, 30% by the teacher or another child, and 10% by the child and another person in combination. A larger body of data is necessary to permit analysis of the individual differences in problems and problem-solving, as well as the variations that occur as they may relate to differences in age, sex, etc.

Source: Dawkins, Richard, Hierarchical organization: a candidate principle for ethology. In P.P.G. Bateson and R.A. Hinde (Eds.), Growing points in ethology. London: Cambridge University Press, 1976.

1. Summary: Dawkins argues that a real understanding of behavior and neurological organization will only come from distillation of general principles at a higher level of analysis than the massive cataloging of behavioral patterns and neurological connections now occurring. He suggests that Hierarchical Organization (see definition in section #4 below), as represented by nested subroutines within a computer program, may represent a general explanation useful in explaining a broad range of behavioral, structural and social phenomena.

Three theoretical justifications for hierarchical organization are set forth. The first is that of evolutionary stability, primarily in the sense that organization into a set of semi-independent sub-assemblies such that mutation might affect only a limited area of the system would increase the likelihood of adaptive modification. Another advantage is that of local administration, the possibility of low-level integration of decision-making as near as possible to the level at which the behavior is enacted. The final advantage is that of reducing redundancy. As an example, a "unit" such as arm-raising could be incorporated (as a unit) into a number of higher-level behaviors, such as lifting or pointing.

The model of behavior derived from a principle of hierarchical organization is one of a sequence of decisions leading to observed behavior. A decision is defined as an event which itself could not easily be predicted, but from which future events can be predicted. Each behavior is seen as the result of a process which in effect "works its way down" a decision tree, choosing among alternatives at increasingly lower levels of integration. Dawkins suggests that the best criteria for determining the appropriateness of a particular hypothetical hierarchical organization is in terms of the mutual replaceability of between-cluster transitions. An index of mutual replaceability of two behaviors is the similarity of correlation between those behaviors and other behaviors. He notes that behaviors which are mutually replaceable would very probably not be sequentially close. Using the analogy of a menu, he suggests that two different fish dishes are mutually substitutable in the second slot of a four-course dinner; they are therefore unlikely to be served up in succession.

Dawkins suggests that hierarchical organization represents a principle that could potentially explain the complexity of information storage and processing, the complexity of perceptual processing, and the complexity of controlled output of behavior.

2. Major implications for a definition of teaching: The concept of hierarchical organization may turn out to be useful in conceptualizing certain kinds of teaching behaviors, although Dawkins does not specifically apply a model to human behaviors in his discussion. The concept of mutual replaceability may be useful in categorizing behaviors that occur, as well as analyzing interaction data. As a hypothetical example, it might well be found that teacher behaviors such as showing a threat-face or raising his or her voice are mutually-replaceable in terms of the criteria listed above. This would suggest that these behaviors would fall into the same category, perhaps conceived as alternative responses to behaviors seen as disruptive. As a hypothetical example, the above is an obvious one in which analysis via mutual replaceability doesn't result in a new categorization. It may be that application of this approach would lead to clustering of behaviors that would not otherwise be put into the same categories.

3. Major implications for research on teaching: (cf. #2 above).

4. Categories and definitions:

Hierarchical organization is defined via the following axioms:

There exist elements: A, B, C, etc., and a relation:

'is boss of' (inverse: 'is bossed by').

A is superior to B when either

A is boss of B or

A is boss of an element which is superior to B.

A hierarchy is a set which satisfies:

- 1) There is no element in the set which is superior to itself and
- 2) There is one element in the set, to be called the hierarchy, which is superior to all the other elements in the set.

A number of possible types of hierarchies are distinguished.

A hierarchy is branching if it includes at least one element which is boss of more than one element.

A hierarchy is linear if it is not branching.

A (necessarily branching) hierarchy is overlapping if it includes at least one element which is bossed by more than one element.

5. The nine elements:

1) Student: A student would be perceived in terms of hierarchical organization in a number of respects. To begin with, he or she is a member of a social structure (or several overlapping social structures) which are likely to be hierarchical in nature. A student's perception and information-processing in general would be perceived in terms of hierarchical organization, using recoding processes to reduce redundancy in a hierarchical manner that would simplify processing by forming categories of concepts and percepts. Finally, a student's behavior is seen in terms of a hierarchical process of decision-making between alternative courses of action proceeding down a hierarchy of behaviors that finally leads to an emerged act or pattern of actions.

2) Teacher: A teacher's social position, information-processing and behavior would be conceptualized in a manner identical to that of a student (cf. #5.1 above).

3) Other human elements: This category is not specifically discussed (but see #5.1 above).

4) Role: The structure of roles could also be perceived as a hierarchical organization, and as such could be either a linear hierarchy (as in a linear dominance structure), a branching hierarchy (more likely, as in the case in which a teacher is seen to be the "boss" of a number of other persons, some of whom are on an equal level in terms of their position in the social structure), and/or overlapping with roles in external settings.

5) Time: This category is not discussed.

6) Place: This category is not discussed.

7) Task: Dawkins suggests, in discussing behavior not directly related to school activities, that there may be a hierarchical organization of tasks. This is the case in two senses. First of all, there can be a priority structure of tasks (such that teachers and students may both have their own prioritization of tasks, which are likely to differ from each other). Second, he discusses a hierarchical organization of tasks in the sense that deciding to undertake a certain task or activity implies the performance of other subtasks.

8) Standards and sanctions: By extension, the possibility of a hierarchical structure of standards and sanctions can be considered. This would imply a graded structure of standards, infractions and corresponding sanctions, such that at each level of infraction

there would be one or more alternative sanctions that might be employed, but there would be other sanctions that would be considered "too severe" or "too lenient" for a particular offense.

9) Communication: Communication could be hierarchically organized in a classroom in terms of who communicates what kind of information to whom. In particular, it is to be expected that there are great differences in the kind of communication that occurs from a teacher to students and that that occurs in the reverse direction, such that there is an asymmetry that corresponds to the social structure of the classroom. The concept of mutual replaceability may prove useful in categorizing the kinds of communicative behaviors that occur, such that a number of such behaviors might function as alternative communications at a particular level of the hierarchy of communication signals.

--Reviewed by Kevin Miller

Source: Edelman, M. & Omark, D. Dominance hierarchies in young children. Social Science Information, 1973, 12, 103-110.

1. Summary: The purpose of the study reported in this article was to see whether a dominance hierarchy, as found in primate groups, could be identified in the social structures of groups of children. The authors looked at the dominance hierarchy within two theoretical perspectives. First, within the ethological tradition, the authors sought to identify a dominance hierarchy as characteristic of our species and as a feature showing continuity across species. Second, they viewed the dominance hierarchy as a cognitive content in Piaget's theory of intellectual development. Specifically, they suggested that the real relationships within the hierarchy provided content with which to practice the operation of seriation.
3. Major implications for studying teaching: In order to find out whether a dominance hierarchy existed in the classroom, the investigators asked the children who they thought was the "toughest" of a pair of children and then determined the amount of agreement among all the children about the dominance relationship in each pair. The rationale for this procedure was that if children agreed on who was toughest, their behavior would reflect that judgment. No observational data are reported in this study, but the authors note that informal observations of classroom interactions revealed patterns consonant with the children's perception of dominance. Details of the procedure, which varied according to the children's ages, are given in section 6. The method seems to be an effective way of finding out how children perceive their social environment.
4. Categories: The dimension "toughest" is only one characteristic involved in dominance relations, but seemed to be more salient for the children than other characteristics such as intelligence, size, and ability to make friends. Children in a pilot study defined "toughest" as being strong, fighting with others, and being able to get what one wanted. A "dyad of established dominance" is a pair of children in which both members agree independently that one is tougher than the other.
5. The nine elements: The variables studied, including age and sex, relate to the element, student. The results of the study indicated that there was a stable dominance hierarchy for grades one through four, with males rated as dominant most often by both males and females. There were no sex differences in accuracy of perception of dominance. Apparently, girls recognize the dominant boys as well as boys do, even though girls interact with the boys relatively infrequently.
6. Description of the study: In this study, different response measures were taken for children at different levels in order to determine dominance relationships between pairs of children. Nursery school children and kindergarteners were asked to identify photographs of their classmates (including themselves) and then to indicate who was

tougher of a pair. First through fourth graders were given an alphabetized class list and were asked to number the names in order of toughness. The children's answers were compared to determine agreement as to their position relative to each other. Because the nursery school children did not show awareness of dominance relationships, the investigators paired children face-to-face and asked them "who's tougher?" In this situation, about half of the children responded "me" even when the other child in the pair responded "me" also. Although the children did not seem to understand that both in a pair could not be "tougher", they demonstrated that they knew what "tough" meant and they made accurate size comparisons with wooden blocks. The kindergarten children were able to choose the first 3 or 4 toughest children from the photographs, but were unable to order the rest of the class by themselves. First graders were able to order the entire class and could use a printed list successfully.

--Reviewed by Susan Frey

Source: Ginsburg, H., Pollman, V., & Watson, M. An ethological analysis of nonverbal inhibitors of aggressive behavior in male elementary school children. *Developmental Psychology*, 1977, 13, 417-418.

1. Summary: Infrahuman species have been found to possess appeasement mechanisms which put an end to intraspecific aggression and ensure that it is not fatal. Such mechanisms have generally not been explored in human beings, despite the fact that they are prominent features of the behavioral repertoires of most other species (e.g., wolves either expose their necks or lie passively on their backs with hind legs wide apart and abdomen exposed, to indicate submission and stop an agonistic encounter).

Darwin suggested that "making oneself smaller" in body stature may serve such an appeasement function in human beings, noting the prominence of this behavior in ritualized greetings (e.g., bowing, kneeling, etc.). The authors explored whether or not making oneself smaller could be considered as a human appeasement behavior, by looking at the relations between reductions in body stature and the cessation of fights among male elementary school children.

2. Major implications for a definition of teaching: This study suggests that humans may have a repertoire of nonverbal behaviors aimed specifically at regulating agonistic encounters. Persons engaged in teaching or learning can be expected to have these behaviors in their repertoire as well, and such appeasement gestures may be important in regulating the social interaction involved with teaching.
3. Major implications for studying teaching: This article points to the possible importance of studying postural factors in teaching. If it is the case that making oneself smaller serves an appeasement function in agonistic encounters, the use of such behaviors (and their opposite) in classroom situations should be noted. Behaviors such as standing up and sitting down at a desk could involve this mechanism, with the possibility that a teacher might exert his or her dominance over children by standing up and making sure that they sit down.

The methodology of this study also may be applicable to classroom observation. The authors collected videotaped records of all agonistic encounters between boys in grades 3-5 on the school's playground, using a broad definition to collect this basic data. The authors were also able to directly measure their belief about the importance of making oneself smaller by using a ruler to measure the size of the image of the children at various points in time. The general method appears promising, employing naturalistic observation via the collection of extensive videotape records, then devoting extensive coding and analysis to the records. This method facilitates checking and increasing reliability, and the collection of a relatively uncensored initial record allows for later reanalysis.

4. Categories: "Making oneself smaller" was operationally defined in terms of the size of the child's videotaped image. The authors also noted the kinds of behavior that were involved with this diminution of stature, which consisted of "bowing the head, slumping of the shoulders, head bowing in combination with shoulder slump, lying motionless on the ground, waxy flexibility (in which the child allows the aggressor to

manipulate his body parts without offering any muscular resistance), and kneeling." They also noted the high incidence of shoe tying just prior to the cessation of an agonistic encounter, which was greatly out of proportion to the base rate of such behavior.

5. The nine elements:

1. Students: This article studied elementary school students, and suggests that they are capable of nonverbal appeasement gestures which effectively regulate (and terminate) agonistic encounters. It is reasonable to expect that such behaviors extend to actual classroom situations as well, suggesting that children in grades 3-5 have the capability of effectively regulating dyadic encounters in the absence of adult intervention.
2. Teachers: The study did not directly concern adults, although it is reasonable to assume that adults are also in command of the same kinds of symbolic behaviors, and may well take advantage of behaviors serving appeasement functions on the part of their students, in the service of regulating classroom interaction.
3. Other human elements: These are not specifically dealt with.
4. Role: The article raised the possibility (citing Darwin's belief) that a number of social gestures (e.g., bowing) that serve to express and establish role relations may have their origin in basic appeasement behaviors that serve to regulate agonistic encounters. The article does not investigate this possibility, but it raises an intriguing point.
5. Time: Time was not a variable in this investigation.
6. Place: The study investigated behavior on a school playground, which raises the possibility that the kinds of behavior observed may be substantially inhibited or modified in other places, such as a classroom setting.
7. Task: Task was not a variable in this study.
8. Standards and sanctions: The study suggests that standards and sanctions involved with the important task of regulating intra-specific aggression may be biologically established to the point that symbolic non-verbal appeasement gestures are effective regulators of such behavior. Such behaviors may also play a role in the means by which other kinds of standards are enforced in school settings.
9. Communication: This study suggests that important communication leading to the ending of fights can take place on a nonverbal level.

6. Description of the study:

a) Behavior: The study looked at naturally occurring behaviors on an elementary school playground.

b) Setting: Elementary school playground during recess.

c) Data: An observer collected videotaped records of agonistic interaction, with an aggression being defined in terms of 5 specific modes of attack: hitting, kicking, pushing, pulling or jumping upon another child. The authors used a ruler to measure size of a child's image on the videotape at various points during the agonistic encounter, and developed an observational system to describe the interaction.

e) Data analysis: Primary data analysis consisted of comparing the probability of diminution of body stature immediately prior to cessation of aggression to random expectations.

--Reviewed by Kevin Miller

Source: Gottman, J. Nonsequential data analysis techniques in observational research. In G. Sackett (Ed.), Observing behavior (Vol. II): Data collection and analysis methods. Baltimore: University Park Press, 1978.

3. Major implications for studying teaching: Assuming that a researcher has a matrix of relative frequencies (rates) of a set of behavioral categories, Gottman suggests procedures to be used in answering various research questions.
 1. What sorts of subjects are involved? Are there different groups in the matrix? In this case, carry out a taxonomic procedure such as one of the following to get a set of clusters of subjects, each with a different profile:
 - a. Use distance indices to see how far apart the profiles are (both between and within groups). A computer program for this task is described by Overall and Klett in Applied multivariate analysis, N.Y.L McGraw-Hill, 1972.
 - b. Use covariance indices that are based on the correlation between two profiles. Covariance indices usually produce more consistent results than do distance indices.
 2. How do these coding variables cluster within this sample of subjects? To address this question, use variable reduction procedures which represent each variable as a weighted sum of factors. Two procedures are the following:
 - a. principal component analysis. The advantage of using this type of analysis is that it identifies one component that accounts for the most variance. Also, the factors produced are independent. The author mentions a problem in interpreting the results: two variables loaded on the same factor may not measure the same category of behavior. For example, "retaliating an attack is probably correlated with receiving positive interaction from peers in nursery school children, but the two categories may not be tapping the same dimension." (p. 51)
 - b. factor analysis. Two common orthogonal types of factor analysis are (1) quartimax and (2) varimax. Using quartimax criterion, one rotates factors so that each variable loads mostly on one factor. With the varimax criterion, factors are rotated so that each factor loads mostly on one variable.
 3. What set of variables, with what respective weights, are best at discriminating among the groups of subjects? A discriminant function procedure such as a stepwise procedure found in SPSS can be used to answer this question. The stepwise procedure is especially useful in selecting a set of variables from a complex

Review of Gottman (1978), pg. 2

coding system. This procedure could be used to identify behaviors that separate "problem" children from non-problem children.

--Reviewed by Susan Frey

Source: Hollenbeck, A. Problems of reliability in observational research. In G. Sackett (Ed.), Observing behavior (Vol. II): Data collection and analysis methods. Baltimore: University Park Press, 1978.

1. Summary: This chapter discussed problems of definition (of reliability) and problems with the observing unit. With respect to defining reliability, the author notes that not everyone agrees on what is meant by accuracy and stability, which are two requirements for reliability of measures.
3. Major implications for studying teaching: Before describing statistical tools available for assessing reliability, the author emphasizes that observer agreement is not a measure of accuracy unless it is compared to some established standard. Also, it is not a measure of stability unless it is extended over repeated trials. Statistical methods available include variance analysis techniques "to assess error variance contributed both between and within observers, as deviation from a standard, and from a number of intervening variables unique to a given study." (p. 81) Four techniques are listed:
 1. multiple regression model (Kerlinger and Pedhazur, 1973)
 2. theory of generalizability (Cronbach, Gleser, Nanda & Rajaratnam, 1972)
 3. regression model using dummy variable coding (Cohen, 1968). This can be used to overcome the problem that coding schemes do not generate interval scale measures. Winer (1971) reviews other procedures that can be used for the same purpose.
 4. observer agreement scores - to be used in a new situation or with new observers after the instrument has been "proven" reliable.

There are two main influences on reliability that need to be considered, observer influence and scoring system influence. First, within observer influence there are the following possible effects of observer bias:

1. omission
2. commission
3. communication of expectancies to the subject
4. problems in establishing initial accuracy. One way to ease this difficulty is to aim for consensus among several observers for a given behavior.

Forms of "subject bias" also come under the heading of observer influence. Sources of subject bias are observer conspicuousness, subject-observer interactions which disrupt the subject's normal behavior, and subject's perception of reasons for doing the study. Finally, "observer drift" can occur, reducing stability across repeated observation times. This seems to be minimized when observers know that they are being assessed by their supervisors.

There are three types of scoring system influences listed in the chapter:

1. When molar behavior is recorded, problems are likely to result from ambiguity of categories.
2. Molecular categories can be so narrowly defined, that the observers will not know which label to use for a particular behavior.
3. The complexity (relative number of coding categories and distribution of behaviors over categories during an observational period) can also affect reliability.

The following are indices for relating the reliability scores of new or smaller numbers of observers to known estimates of reliability.

1. Percentage agreement. The strengths of his method are that it is easy to compute and is sensitive to systematic errors. It has serious weaknesses, however. It does not provide any index of chance levels of agreement, provides no information about the source of error, and has no metric properties for use in further mathematical analysis.
2. Correlation coefficient (Pearson). In order to use this index, the scoring system must meet the requirements of interval scaling. The correlation coefficient has well-known metric properties but it can overestimate agreement, especially when many categories are used.
3. Coefficient of concordance based on rankings. This index is used by observers who have ranked the same behaviors. It is valuable when the results of the study are evaluated using only rank order information from original scores.
4. Chi-square. This statistic provides a measure of the goodness-of-fit between the observer's scores and predetermined expected outcomes. The weaknesses are that it provides only an overall index of association and that it is inappropriate when certain codes are infrequently represented.
5. Scott's coefficient. This index includes a correction for chance.
6. Kappa (Cohen, 1960). This index is highly recommended for use instead of percentage agreement. It is easily computed, handles chance agreement, has a complete sampling theory, can be used with more than two observers, and generates a table that shows all entries where agreements and disagreements occur.

--Reviewed by Susan Frey

Source: Holm, R. Techniques of recording observational data. In G. Sackett (Ed.), Observing behavior (Vol. II): Data collection and analysis methods. Baltimore: University Park Press, 1978.

3. Major implications for studying teaching:

Voice recording is typically used to record all molar behaviors for a focal individual or if the observation opportunity is unique, since this method does not require a priori behavior classification. Summarizing the data generated by this method can be extremely time-consuming and tedious. First, a transcript is made, then the transcript is analyzed into segments and then behavioral categories, then data are transferred to a data sheet for processing. The entire process can take up to 10 or 15 times the original observation time.

Event recorders can handle up to 20 behavior categories and can measure frequency, duration, and sequence. They are simple to operate: the observer presses a button at the onset of a behavior and the button activates a pen which records the onset and length of the behavior.

Checklists are inexpensive and allow immediate access to the data. All that is needed includes a pencil, data sheet, and a device to indicate when the observation interval has elapsed. If the number of categories is small enough, the checklist is usually set up with columns representing time blocks and rows representing behaviors. Checklists can handle only modified frequency sampling. It is possible to get sequential data by using punches on computer cards for recording behavior, but this method can be awkward.

Clocks and counters can be used with a small number of behavior categories when sequential information is not needed. An advantage of these tools is that they provide data in summary form at the end of an observation period.

Digital keyboards are suited to a hierarchical system of coding behaviors in which each digit represents one dimension, such as modality, focal point of the behavior, and the behavior itself. Using this system has several advantages: the data can be easily collapsed and analyzed by dimensions, observers can learn the code more easily, and the code can fit in unanticipated behaviors.

--Reviewed by Susan Frey

Source: Humphrey, N.K. The social function of intellect. In P.P.G. Bateson and R.A. Hinde (Eds.), Growing points in ethology. London: Cambridge University Press, 1976.

1. Summary: Beginning with the assumption that organisms only develop new capacities when their environment requires them to, Humphrey rejects the argument that some primate species (particularly man) are much cleverer than they need to be. Yet what are the specific problems to which human intelligence can be considered an answer, and how did a developing intelligence contribute to the biological fitness of its possessors?

Humphrey first considers a "Robinson Crusoe" notion of intelligence, that it represents an adaptation to the physical environment that leads to practical inventions that bestow increased inclusive fitness on its possessors. While this ability would seem to be obviously important, Humphrey suggests that the important practical problems of living actually demand only relatively low-level intelligence. This is particularly the case in advanced primates such as chimpanzees and human beings, who develop skills through observational learning rather than through the creative use of practical intelligence. Humphrey suggests that subsistence technology would function as a substitute for intelligence rather than requiring it.

The question, therefore, remains: Why do the higher primates need to be as clever as they are, and, in particular, so much cleverer than other species? Humphrey suggests that the answer lies in the fact that human beings and other higher primates acquire practical skills through the observation of competent conspecifics in a social environment, an environment which provides both a medium for the cultural transmission of information and a protective environment in which this individual learning can occur.

Society is problematic for animals who live in groups as structured and complex as those of higher primates. Humphrey suggests that there are benefits to be gained for each individual member both from preserving the overall structure of the group and at the same time from exploiting and out-manoeuvring others within it. He compares social life to a vastly more complicated version of chess, and asserts that this is a game that higher primates such as humans have been playing since we were babies.

Humphrey asserts that society becomes complex because of the need to teach the immature members the subsistence technology of the society, and that this need leads to selective pressures to increase the length of infantile dependency (or studenthood) and to retain older animals within the community (as teachers). This interdependence creates a complex and potentially explosive environment. The twin tasks of doing well for oneself in the social community while maintaining the social contract on which the

fitness of the whole community ultimately depends requires remarkable intellectual abilities.

If this intellectual prowess were correlated with social success, and if this social success meant high biological fitness, then any heritable trait which increased the ability of its possessor to outwit his fellows would spread through the gene pool. This would in turn change the social environment, such that it would require a greater amount of the requisite type of intelligence in order to outwit other members of the society, leading to an evolutionary "ratchet effect."

Yet time spent socializing with conspecifics, learning technological skills, and trying to outwit your fellows is time spent away from the mundane tasks of gathering food and supporting yourself. So, Humphrey asserts, the growth of intelligence will be a self-limiting process at the point at which time spent socializing is no longer more than compensated for by gains in productivity resulting from skills acquired during that social period. He further suggests that when the ancestors of modern man moved into the savanna, they discovered an environment in which technological knowledge paid new and continuing dividends, leading to the creation of a social system of unprecedented complexity to support the increased schooling given to children in subsistence skills.

An "unintended consequence" of the social origins of intelligence might be a tendency of human beings to deal with nonsocial objects in nature as if they were social beings, as in people attempting to bargain with nature.

2. Major implications for a definition of teaching: Teaching is defined as the process by which older, mature organisms save younger, immature organisms the trouble of inventing for themselves the technological "tricks" of their society. Humphrey suggests that teaching will occur under conditions where the time "wasted" in teaching and learning is more than compensated for by the gain in productivity due to learning. He calls attention to the social consequences of the complex social structure required to support infantile, non-productive "learners" and to induce mature organisms to teach them, as exerting great selective pressure on the intellectual capacities of higher primates.
3. Major implications for studying teaching: The article is not a methodological one, hence it does not deal with this issue.
4. Categories and definitions given by author: Humphrey defines intelligence in the following words: "An animal displays intelligence when he modifies his behavior on the basis of valid inference from evidence."

5. The nine elements:

1) Student: The student is an immature organism in a state of "untrammelled infantile dependency" on the older generation. Humphrey suggests that a large amount of social structure may be explained by the necessity of supporting the young during a student period, and of providing them with the opportunities to learn the subsistence skills necessary to survive in their society. Since students will also become full-fledged members of this complicated society, they also must develop the skills necessary to maintaining the society while attempting to exploit and out-manuever his conspecifics. The student is learning the material skills of his society, but at the same time he is gaining experience in the complex version of chess known as social interaction, an ability that is critical to his adaption in the society.

2) Teacher: The teacher is a mature organism who has somehow been induced to spend his or her time in providing the young with the experiences necessary to their acquisition of the social and practical repertoire of the species. Humphrey calls attention to the terms that induce adults to remain within the community and function as teachers, and suggests that it is an essentially explosive problem in primate societies, since the interests of the adult "teachers" and the infantile "students" may often conflict, and an adult who spends his time caring for and teaching infantile conspecifics is not out gathering food for himself. Humphrey raises the question of how the "teacher" might improve his or her own inclusive fitness by functioning as a teacher. In human societies, this question of what economic and/or biological motivations lead persons to become teachers may well be worth investigation.

3) Other human elements: Other elements, as discussed by Humphrey, include primarily other adult members of the society who must be induced to support nonproductive infantile students (and possibly teachers), and suggests that this is one of the problems that human intelligence evolved in response to.

4) Role: Role is not discussed in this article.

5) Time: The only time element discussed by Humphrey is evolutionary history, on which he comments that "the formative years for human intellect were the years when man lived as a social savage on the plains of Africa."

6) Place: Place is not discussed in the article.

7) Task: Task is not discussed as a variable, although the task of education is said to be equipping the infantile organism with the repertoire of social and technological skills that characterizes the society to which it belongs.

8) Standards and sanctions: Humphrey asserts that "the selfishness of social animals is typically tempered by what, for want of a better term, I would call sympathy...a tendency on the part of one social partner to identify himself with the other and so to make the other's goals to some extent his own." He suggests that the motivation to avoid breaking the social contract that maintains a society is a strong, internal one, although higher primates will attempt to work their way around any social sanctions to achieve their ends through cleverness.

9) Communication: Communication is not specifically discussed in this article, although as a social behavior it would be seen as a means by which members of a society could maintain their social relationships while attempting to exploit and outwit each other.

--Reviewed by Kevin Miller

Source: Hutt, S. & Hutt, C. Direct observation and measurement of behavior. Springfield, IL: Charles Thomas, 1970.

1. Summary: In this volume, Hutt and Hutt argue for the importance of rigorous observation of behavior in the scientific study of humans. They provide detailed descriptions of the methods which they advocate for use in observing behavior and they discuss specific studies that demonstrate use of these methods. In the present review, the first two chapters, "Why measure behavior?" and "Observational approaches to the study of behavior" will be discussed together with the concluding chapter, "A forward look: Towards an ethology of man." These chapters provide a general context for the remaining chapters which will be discussed separately.

Chapter One argues that observational studies of humans are needed in psychology for several reasons. First, they are necessary in order to get a natural history of the behavior of an individual. Knowing how an individual behaves over a period of time, in different settings and at different hours of the day, can be extremely useful in interpreting the person's responses under controlled conditions. As a hypothetical example, a child's failure to engage in exploratory manipulation of an object in a laboratory may be partially understood if one knows that he tends to be passive at that time of day or has had much previous experience with similar objects. Observational data that describe an individual's "natural history" or behavioral repertoire can also be useful in setting up experiments the results of which clarify rather than lead to misinterpretations of naturally-occurring behavioral sequences. The authors suggest that observational research is especially needed in studying an individual's adjustment to the physical and social environment, including exploration and play, communication, cooperation, aggression, and territoriality. The point is made that questionnaire and interview studies of such phenomena are often inadequate, since there is likely to be some discrepancy between what a person says he does and his actual behavior. The authors note that observation may be the only effective means by which the behavior of certain subjects, e.g., very young children, can be studied.

In a brief discussion of traditional studies of clinical adjustment, Hutt and Hutt cite several inadequacies of such studies resulting from the use of crude, ordinal ratings of behavior. In some studies, a single, easily observed variable is chosen as representative of the subject's overall behavior, thus ignoring the way in which the whole behavioral repertoire is structured. For example, if an investigator selects locomotion as the only indicator of a child's hyperkinesis, he will not be able to study the relationship of locomotion to aggression or other significant behavior. In

another use of ordinal ratings, several behavioral ratings are added together to yield an overall score. This practice is severely criticized on the grounds that it is absurd to add together ordinal scores of qualitatively different behaviors. Another problem with additive scores is that they are most likely statistically distorted indices, since the component measures are often highly intercorrelated. In a third type of study in which ordinal ratings are used, a single gross measurement, such as a "social adjustment score," is interpreted as a global assessment of adjustment. This procedure is also found inadequate because in most cases, the behavioral measurements which comprise the global assessment are weighted unequally. Finally, the practice of correlating behavioral and physiological measures is said to be inappropriate in most studies because the behavioral measures are usually crude while the physiological measures are precisely quantified. The authors assert that, contrary to popular opinion, behavior can and should be precisely quantified.

The second chapter outlines the characteristics of the ethological approach as distinguished from two other traditions in which behavioral observation is used: experimental psychology and ecological psychology. The main feature of an ethological study that sets it apart from a study within experimental psychology is that the ethological study starts with the construction of an ethogram. "Before attempting to modify behavior, the ethologist demands to know what behavior there is to modify" (p. 16). Another distinction between the two approaches is that experimental psychologists tend to concentrate on varying the stimuli while observing a single, easily measured response while ethologists focus on details of the response, recording as much variation as possible. Ethologists and ecological psychologists are alike in that they spend a great deal of time becoming acquainted with the subjects in their natural habitats before attempting to set up experiments. However, there are important differences between their approaches. Ethologists study molecular units of behavior, such as facial expressions, because they believe that facial expressions and other motor patterns "play vital roles in social interaction" (p. 22) and provide information about the effects of the environment on behavior and about underlying functional mechanisms. Ecological psychologists attend to molar units of behavior which they describe in terms of the inferred goals of the subject. When recording their observations, ecological psychologists will often attach inferential labels to the motor patterns they observe, while ethologists try to record strictly what they see and hear without making inferences about the motivation or emotional state of the subject. Chapter Two ends with a discussion of the four aspects of behavior with which ethology, as the biological study of behavior, concerns itself: causation, function (survival value), ontogeny, and phylogeny. (See review of Tinbergen, 1972, 1976 for discussion of these four aspects.)

Chapter Ten summarizes some contributions of ethology and suggests future directions for ethological research. One of ethology's achievements, according to Hutt and Hutt, is that it has shown that behavior occurring in the natural settings of individuals can be analyzed into natural units and that the units are structured coherently, tending to occur in predictable sequences. The authors suggest that in attempting to evaluate observational studies, scientists should look at the method in terms of its appropriateness and should realize that the differences between observation and experimentation is one of degree rather than one of a mutually exclusive nature. Hutt and Hutt anticipate that neuroethology, the recording of behavior simultaneously with physiological measures, may prove to be a fruitful line of investigation in the future.

3. Major implications for studying teaching: Hutt and Hutt would suggest that precise measurement of observable behavior in elementary classrooms would yield important information for educational psychologists. Taking the ethological approach, a researcher would first try to get an overall picture of student and teacher behavior in different settings and at different times in school. He or she would devise molecular categories of behavior displayed in exploration, play, and social interaction such that these categories are easily identified by other observers and are free from inferential labels. When focussing on specific behavioral units of interest, e.g., smiling, the researcher would try to identify the releasing stimulus for that behavior. In adopting an outsider's view of human behavior, i.e., temporarily ignoring assumptions about children's inner experience, and trying to record objectively the behavior that is being displayed, the ethologist may be able to supplement the information available from interviews and tests about the conditions under which children learn best.
5. The nine elements:
 1. Student: Studies in which precise measurements of behavior are taken simultaneously with physiological measurements, such as the EEG, could be helpful in understanding the behavior of a child with special problems, e.g., an autistic child.
 2. Student-teacher interaction: Although much significant behavior of humans, especially adults, is verbal, covert, or both, Hutt and Hutt would maintain that observational studies of non-verbal behavior of adults in social interaction are important to undertake. We need a better understanding of the effects of teachers' and students' gestures, postures, and facial expressions on each other.

1. Summary: This chapter discusses an important phase in ethological studies of child behavior, namely, becoming as familiar as possible with the child's behavioral repertoire. Hutt and Hutt stress the need for repeated sampling of a child's behavior in different situations in order for patterns of recurring behavior to be discovered. They mention that in many studies, investigators superimpose their preconceived notions about what behavior should be present and thus ignore a great deal of what is actually present. When investigators have continued to sample behavior as unbiasedly as possible, they will usually find that an individual's behavioral repertoire is not infinitely variable and that it is composed of a limited set of recurring patterns.

The behavior elements which comprise a behavioral repertoire are identified in terms of two major criteria--morphology and function. The idea of a behavior element is derived from Lorenz's notion of behavioral Gestalten, which "appear to us as patterns which are easily remembered and recognized" (p. 30). When defining behavior elements according to their morphology, one would consider the body as a series of contours in three-dimensional space and activity as changes in the orientation and direction of contours. End points of movements and changes of posture mark the boundaries of behavior elements. When an element, such as a stride, occurs over and over again, it is given a name that implies continuous movement, such as walking. In order to quantify the element defined by morphology, one typically counts the frequency of occurrence of motor patterns or measures the time spent in certain postures. It is also common to compute mean duration of actions or calculate the velocity of movements. When defining an element in terms of function, one names the element by noting the effect of the behavior on either the physical or social environment. Hutt and Hutt note that using function as a criteria can mask important differences between ways in which a given effect is achieved. For example, in a situation in which a boy from each of two groups of boys is asked to organize the group into a line, the behavior involved in accomplishing that end may vary greatly from individual to individual. The best solution to this problem is to identify elements in terms of both morphology and function, if possible. When focussing on function, one can quantify behavior elements by counting the number of different stimuli sampled, measuring the total amount of time in contact with a stimulus, or calculating the rate of change effected in a stimulus.

The authors recognize the difficulty of formulating accurate descriptions of behavior. In defining behavior categories, investigators usually use everyday language, consult the dictionary, and use other investigators' definitions, if possible. Dividing a behavioral repertoire into the following five main categories of movement can be helpful:

1. visual fixations
2. postures
3. locomotion
4. manipulation
5. gestures

A suggested procedure for formulating definitions of behavior elements while in the field is presented. See item #3 below for details of this procedure.

3. Major implications for studying teaching: Adapting Hutt and Hutt's method of constructing behavioral repertoires for individuals within the school setting would involve spending a great deal of time observing a few students and teachers. In contrast to the more common practices of conducting brief experiments, administering questionnaires, or scoring behavior according to a priori classification systems, formulating behavioral repertoires would require much time in the initial stages of investigation.

One limitation of using the suggested five-part classification of the elements in a behavioral repertoire in application to education is that no verbal categories are included. Of course, one could add verbal categories to the set. Recording both verbal and non-verbal behavior simultaneously, when appropriate, would yield valuable information which is not presently available. For example, one would study the relationship between posture and quality of verbal interaction in a group of students.

The authors provide some specific suggestions for constructing definitions of behavior elements. First, while observing behavior, the researcher should write down brief activity words which describe the behavior he is observing. Each activity word should be written at the top of a file card. Then, the observer should try to define the activity words as tersely as possible, writing definitions on the respective file cards. If two or more behaviors which have the same name seem to be significantly different and if they occur relatively frequently, then the differences should be specified. When in doubt as to whether or not to split behavior into smaller units, one can follow the rule of thumb stating that it is better to split. Distinct patterns that are saved in splitting may be important, and if not, they can always be combined at a later point in the study. While observing it is most helpful to work with at least one other person in order to check the accuracy of definitions. If one is working alone, it is especially crucial to have intimate and sustained contact with the subjects in order to verify the accuracy of the behavior definitions. Finally, the problem of when to stop adding elements to the repertoire is addressed. The authors suggest that the researcher plot a cumulative percentage curve of total time spent in a behavior against the number of elements in the catalogue. If one finds that a small number of elements account for a large percentage of the total time, then he can "close the dictionary."

4. Categories: See item #1 for a definition of behavioral Gestalten.

5. The nine elements:

1. Student: A student would be conceived of as an individual with a complex but orderly and finite behavioral repertoire. Not all of this repertoire is amenable to observation. However, by studying a student in a specific place or in interaction with a teacher or certain other students, a researcher could perhaps construct a setting-specific repertoire.

1. Summary: This chapter discusses the use of tape recording in the initial phase of observational research and includes descriptions of several illustrative studies. Tape recording a spoken commentary of behavior is said to be appropriate in this phase because the observer is still getting to know the subject and has not established behavior categories which are necessary for using checklists or event recorders. Audio taping is preferred even over video-taping, because the range of behavior of interest has not been defined clearly enough to justify the high cost of video equipment.

By uttering on tape an abbreviated commentary as contemporaneously as possible with the behavior, one can get a rough estimate of duration as well as an account of what behavior occurred. The authors recommend that, if enough tapes are available, the researcher should simply jot down each action of interest and its duration while playing back the tape, rather than transcribing the entire record.

Several studies in which tape recording was used are discussed in this chapter. The two studies that seem most relevant to education will be discussed briefly in this review. The first study (Cockrell, 1935), investigated the effects that changes in kind of play materials available had on children's behavior. The second study (Hutt, Hutt, & Ounsted, 1965), compared the behavior of children with and without upper central nervous system lesions in different play settings. (See item #6 for details of these studies.)

3. Major implications for studying teaching: The method used in the studies reported in this chapter is described in section #1. An important feature of Hutt and Hutt's approach to making commentaries of behavior that is evident in their 1965 study is their commitment to recording only observables. For example, instead of saying, "Child looks fearful" they would say "stands still, face whitens, lips tremble, fists clenched, shoulders hunched." By recording behavior in this manner, one can find out "whether in fact all these elements do occur together when we think the child is fearful" (p. 48).
4. Categories: In Cockrell's 1935 study, an interest or attention span was defined in terms of the stimulus. "A child was considered to have shifted his interest when he turned from one toy to another" (p. 45). An activity span was defined in terms of motor patterns. Hutt and Hutt used the same definitions in their study and further explained that activity span was identified by appearance (morphology) and its intensity or amplitude.
5. The nine elements:
 1. Student and place: Hutt et al.'s study demonstrates an effective way to compare the behavior of normal and abnormal children in different places with different materials. Comparing the amount of time that different children allocate to the same kinds of activities in different settings may facilitate understanding of specific dimensions along which children with various types of disorders vary.

6. Descriptions of the studies:

I. Cockrell, 1935:

- a) Behavior: The natural behavior of 6 children between the ages of 2 1/2 and 3 years was observed. The following were noted carefully:
(1) material approached or attended to; (2) time of approach;
(3) shifts in activity while with material; and (4) time of shift in activity.
- b) Setting: Each child was observed alone and with every other child in different play settings, each with a different set of materials as follows:
 - 1. Only a table and two chairs;
 - 2. House-keeping materials: two baby dolls with blankets and carriages for each, crockery, chest containing doll's clothes;
 - 3. Three kinds of blocks;
 - 4. Story books and pictures cut from magazines;
 - 5. Two lumps of clay; 2 boards; 2 boxes of crayons; and 2 pieces of paper.
 - 6. All of the above combined.
- c) Treatment: See #1 above.
- d) Data collection method: Children were observed from a one-way screen and their behavior was recorded in parallel columns for two children at a time.
- e) Data analysis: A graph was constructed showing how the child had spent his time in successive minutes in relation to the play objects and fixtures of the room. Results: children displayed the greatest number of different activities and maintained the longest attention span in the clay-and-crayons situation and the least in the bare room with only table and chairs.

II. Hutt, Hutt & Ounsted, 1965

- a) Behavior: The behavior of brain-damaged and normal children was studied in semi-controlled environments.
- b) Setting: Behavior was observed in four environmental conditions. The conditions are as follows, listed in order of increasing complexity:
 - 1. Room with no furniture, but with windows, radiators, sink.
 - 2. Room with a box of colored blocks.
 - 3. Room with blocks and a passive observer who sat still in one part of the room.
 - 4. Room with blocks and an adult who attempted to engage the child in building a standard design with the blocks.

c) Treatment: Several types of behaviors were noted. Gestures, defined as "bodily movements which did not bring the child into contact with selected parts of the physical environment were of three types: (1) manipulation of parts of the body; (2) complex patterns of coordinated movement, such as dancing; and (3) single movements such as nodding the head.

Three activities which made up block play were observed: (1) looking at the blocks; (2) constructive play (play which resulted in a design or structure); and (3) unconstructive play, which consisted of placing single blocks on the floor, or banging or throwing them. What the authors call "sampling time" was observed. Sampling time is described as the "length of time during which a specific stimulus is engaged by a receptor system" (p. 57).

Three elements of sampling time investigated were duration of visual fixation, manipulatory activities, and attention span.

d) Data analysis: A transcript of the tapes was made and termination of each activity was indicated by double vertical strokes on the paper. Then the tape was replayed in order to time the duration of each behavior. The data were entered on an analysis sheet and the actions were listed in columns as visual, manipulatory, or mobility. Behaviors occurring simultaneously were located on the same horizontal line on the table.

1. Summary: The use of checklists and event recorders in observational studies of animals and humans is described. Both instruments (see review of Holm, 1978 for a description of them) require the availability of behavior categories that are easily recognized and precisely defined. Checklists and some event recorders are limited in that they can only record a relatively small number of behavior categories. Some newer, more sophisticated event recorders such as digital keyboards (described in Holm, 1978) can record many more categories. Data obtained with a checklist or event recorder can be analyzed in several different ways. The following can be calculated: (2) percent time spent in an activity; (b) frequency with which there is a change in an activity; (c) number of different activities; (d) number of stimuli encountered; (e) duration of an activity; and (f) changes in duration of an activity with item.

Of the several studies described in this chapter, three will be discussed. Zurich (1964) observed children's reactions to their failure to solve a puzzle. This study is of interest because both verbal and non-verbal behaviors were categorized. Two studies of behavior in novel situations will be reviewed; the first, (Hutt, 1967) used a checklist and the second, (Cox & Campbell, 1968) employed an event recorder.

3. Major implications for studying teaching: See item #1.
4. Categories: See item #6 for definitions of the behavior studied.
5. The nine elements:

7. Task: Zurich's study suggests that specific tasks may elicit similar behavior patterns in different children. In a classroom, one might study a specific task as one of the determinants of children's behavior.

6. Descriptions of the studies:

- I. Zurich, 1964:

- a) Behavior: Forty preschool children were given a trick puzzle to solve individually in a ten-minute session. Each child was pre-exposed to the puzzle box and then was given the box with pieces taken out. He or she was asked to put the pieces back in the box so that the lid would shut. The box was designed so that closing the lid was impossible unless the pieces were placed in a particular way.

- b) Setting: The children worked individually in a room with an assistant sitting nearby.

- c) Treatment: The following behavior categories were studied:

Categories containing verbal elements:

1. directing--child states the course of action which he wants the adult to follow.
2. rationalizing--child states, for example, "I don't want to do this. This is a stupid puzzle."
3. Seeking attention--an example is "Look what I did."
4. seeking contact--child says, for example, "Come and sit by me."
5. seeking help--child asks for physical or mental assistance.

Non-verbal categories:

1. destructive behavior--e.g., throws object.
2. emotional response--e.g., cries.
3. facial expression.
4. motor manifestation.
5. no attempt--child does not try to solve the puzzle.

d) Data collection: Behavior was observed from behind a one-way screen.

e) Data analysis: Frequency of occurrence of each category was counted.

II. Hutt, 1967:

a) Behavior: The behavior of three to five year-old nursery school children was observed as they played with five familiar toys and one novel toy. The novel toy was a red metal box that had a lever which could be moved in four directions. The lever was constructed so that it registered each movement the child made with it. Two types of incentives were given contingent upon manipulations of the lever. The first was called "no sound or vision" and simply allowed tactile feedback. The second was "vision only" in which the child could see the counters registering each movement he made.

b) Setting: Observations were made in a nursery school classroom, in which an observer sat, as unobtrusively as possible.

c) Treatment: The following behaviors were recorded on checklists:

1. looking (object)
2. holding
3. manipulating (conventional and unconventional) gestures
4. locomotion
5. play (unconstructive and constructive)
6. visual exploration (room)
7. observer-directed behavior
8. manipulating (fixtures of room)

d) Data collection: Behavior was recorded on checklists and also by means of the lever registers. In addition, notes were made by the observers as frequently as possible.

e) Data analysis: The response categories on the checklist were summed at the end of a given interval and the counters were read, giving a measure of manipulatory responsiveness. Percent time attending to the novel object was calculated and an overall distribution of the different activities occurring in a session was obtained.

III. Cox and Campbell, 1968

a) Behavior: The behavior of 20 children between 13 and 15 months of age was studied in two experimental conditions. Each child in both conditions was taken to an observation room with his or her mother. In the first condition, the mother stayed in the room for the entire 12 minutes and in the second condition, she left after 4 minutes and returned for the last 4 minutes of the session.

b) Setting: The child was observed while in a room in which a pile of four toys was available. When the mother was in the room with the child, she was occupied with a questionnaire.

c) Treatment: The following behaviors were recorded:

1. child touching mother
2. child holding mother
3. child speech
4. child movement
5. child play
6. child touching other things besides toys
7. child places object in mouth
8. child crying

d) Data collection: Behavior was recorded with a simple paper-and-pencil event recorder. Duration of behavior was not recorded.

e) Data analysis: The observations were written on a time chart divided into one-minute periods and the occurrence of behaviors in the categories in each period was noted. Using the first four minutes of the session as an indicator of typical performance, the investigators compared the amount of speech, movement, and play in the two groups. They found that the experimental group showed a decrease in all three types of behavior in the mother's absence while the control group showed a slight increase in these behaviors over the 12-minute period. Hutt & Hutt comment that the results of this study would have been more meaningful if duration of behaviors such as crying had been recorded.

1. Summary: The authors caution researchers against assuming that video or film recording is the best method to use in recording behavior. They point out that after filming, one still has to do the first order analysis, i.e., cataloging behavior, and having available a video tape of the observation session can promote attempts to analyze behavior in too much detail. The reader is reminded that, unlike the simpler process of synthesizing data from checklist categories, analyzing data can be very difficult. One prerequisite for the use of film or video-tape is having a set of specific aims for the study before starting. There are five kinds of studies for which filming or video-taping is said to be appropriate. They are studies in which:
 - a. the action is too fast to record by any other means;
 - b. the action is so complex that some features must be ignored;
 - c. behavioral changes are subtle, e.g., gaze behavior;
 - d. sequential changes in complex behavior are the focus; and
 - e. there is a need to measure precise parameters of brief of complex events, e.g., gait.

In general, filming is used for detailed description and qualitative analysis.

Several animal studies are reviewed in this chapter, along with Gesell's and Kessen, et al.'s studies of infant motor patterns. A study which illustrates how filming can be used in combination with other recording techniques will be discussed in the review of Chapter 7, "Social Behavior."

3. Implications for studying teaching: Filming behavior would probably be most appropriate when an investigator had clearly delineated behavior categories and wished to record both verbal and non-verbal behavior simultaneously in a complex situation, such as a group discussion in a classroom. Once motion pictures or video-tapes are obtained, the researcher can analyze particular episodes in slow motion or use a viewer equipped with a frame counter to count the occurrences of certain behaviors. Then, the number of frames can be converted into number of seconds. Video-taping might also be useful to study a child's behavior in relation to a task that requires subtle behavior, such as scanning and visual fixations.

1. Summary: After a brief discussion of the difficulties of observing natural social behavior, the authors present a number of studies that illustrate the use of methods described in previous chapters. The studies described in this chapter are "primarily concerned with the how-and-what aspects of methods and only secondarily with the why-and-when aspects of the phenomena" (p. 126). The study that will be described in this review was conducted by Hutt and Vaizey (1966) and was concerned with the effects of group density upon social behavior.
5. The nine elements: The results of the study seem to demonstrate a relationship between student and place. Changes in the shape of the children's play space seemed to cause individual differences in display of territorial behavior.
6. Description of the study:
 - a) Behavior: The behavior was partially manipulated in that the size of the group in which each child was placed was pre-determined. Children in the study included those who were either normal, brain-damaged, or autistic.
 - b) Setting: The first phase of observations, in which checklists were used, occurred while children were assembled for free play in a rectangular room familiar to them. Three different-sized groups of children were observed: a small group of less than six, a medium group of 7-11 children, and a large group of more than 12. In the latter stage of the study, when tape recording and filming were used, the children were observed in a new playroom which consisted of three connected areas: a larger rectangular space and a square area on each side of it.
 - c) Treatment: In the first part of the study, a checklist was used to determine the frequency of the following behavior categories:
 1. Repetitive play
 2. Constructive play
 3. Destructive play
 4. Stereotypy
 5. Crying
 6. Locomotion
 7. Interaction with adult
 8. Interaction with child
 9. Cuddled
 10. Alone
 11. Attack
 12. Avoid
 13. Boundary
 14. Looking

After observing each child on three separate days under each condition, the investigators found that categories 3 and 11 (grouped together), categories 7, 8, and 9 (grouped together) and category 13 showed the greatest effects of the different density conditions. In the second phase of the study, the observer recorded a fuller description of the interactions on audio-tape. Findings generally confirmed those obtained by checklists. An interesting new feature relating to the change in the shape of the room became evident. The observer came away for the first time with a good deal of territorial behavior. For example, normal children spent time trying to prevent others from intruding upon "their" space. There were individual differences in this behavior; brain-damaged children did not seem to engage in territorial behavior, although they did exhibit possessive behavior. The autistic children seldom fought over possessions, but they sought out larger areas as their personal space than did other children. Finally, motion pictures were used to examine in detail two social encounters of particular interest to the investigators. A frame-by-frame analysis of fighting between two brain-damaged boys revealed that when the attacker hit the other boy, the attacker's eyes were closed. (The authors suggest that the function of eye-closing is to regulate sensory input, or specifically, to reduce fear and enable the aggressor to carry out the attack.) Filming an interaction between two autistic children enabled the investigators to discover that the mild antagonistic encounter was followed by a marked increase in stereotypic behavior displayed by both children. (This most likely indicates an increase in arousal level.)

1. Summary: This chapter discusses the usefulness of four statistical models in predicting the outcomes of behavior sequences. The chi-square model is used in the analysis of pairs of behavioral events. First, a table in the format of a correlation matrix is constructed, listing the behavioral events once in the left column and once across the top. Next, one records in the bottom one-half of the matrix the number of times an event in the left column precedes an event in the top row. The number of times an event in the top row follows an event on the left is the recorded in the upper one-half of the matrix. The row totals yield the number of times an event follows all other events. A rough statistical treatment, in which the expected value is compared with the observed value for each cell, enables one to "see whether two sequential acts occur in association with each other more or less frequently than would be expected by chance" (p. 171). The problem of what is and what is not a significant difference between observed and expected frequencies remains. Thus, this procedure is regarded as most valuable as an initial step in sequential data analysis.

The factor analytic model as employed in a study by Wiepkema (1961) is more powerful than the chi-square method since "it attempts to account for all the correlations in terms of a limited number of sources of variance" (p. 184). This method is particularly useful when attempting to link behavior with underlying motivational systems. One limitation is that it can only take into account adjacent elements and ignores behavior that occurred several steps away in the sequence. In the procedure used by Wiepkema, one starts with a matrix of the kind generated by chi-squares analysis. Spearman's Rho is calculated and the resulting correlations are factor analyzed. The object here is to see how many factors are necessary in order to account for the obtained correlations. Factor loadings are computed using the principle axis method of Fruchter (1954). Then, the relationships among the various behavioral elements are represented in a three-dimensional model, with each item depicted as a vector. In this model, the cosine of the angle between two vectors represents the correlation coefficient between the two corresponding elements. The factor loadings for each element can be found by locating the projection of its vector on each orthogonal axis. "The length of each vector represents the amount of the common variance of that item accounted for by the proposed factors" (p. 174). Hutt and Hutt call this method "highly economical" (p. 175) because it can express the intercorrelations among many events in terms of a small number of variables.

The informational model (Altmann, 1965) can go beyond the factor analytic model in that it treats the probability of the occurrence of an event as a function of up to three antecedent events. Altmann specifies the amount of uncertainty associated with a behavioral event in the following formula:

$$U(y) = -\sum_k p(k) \log_2 p(k)$$

where U is uncertainty associated with y , k is the number of items in the behavioral repertoire and $p(k)$ is the probability linked with each item. For a sequence of four events, the formula is as follows:

$$U_{vwx} = -\sum_{h,i,j,k} p(h,i,j,k) \log_2 p_{h,i,j}(k)$$

where x , d , and v are antecedent events and $p_{h,i,j}(k)$ = proba-

bility that $y=k$ when $x=j$, $w=i$, and $v=h$. No more than four events are considered with this model because additional computations contribute less and less to the reduction of uncertainty. Since the amount of uncertainty about the occurrence of an event depends upon the size of the behavioral repertoire, it is necessary to include more than four elements in the computation when dealing with large repertoires. Thus, this model has limited application in studies of humans.

Finally, the phrase structure grammar model is an attempt to apply the rules of speech organization as specified in psycholinguistics to the organization of non-verbal behavior. This application is based on the assumption that, like verbal behavior, non-verbal behavior consists of a finite set of elements and has a hierarchical structure. This hierarchical structure is represented in the form of a tree diagram in which the terminal symbols cannot be rewritten or replaced by other elements. If two terminal symbols share a common node, they most likely have a close statistical relationship. Marshall (1965) used a phrase structure grammar model to describe the mating behavior of a male pigeon. Hutt and Hutt comment that Marshall's description is full and economical, taking into account more behavioral events and longer sequences than would be possible with Markovian processes. However, they also note Altmann's view that use of phrase structure grammars may be inappropriate and unfruitful when trying to describe non-verbal interactions.

In closing, the authors recommend that researchers apply several different analyses to the same data.

--Reviewed by Susan Frey

Source: Konner, M. Relations among infants and juveniles in comparative friendship. In M. Lewis and L. Rosenblum (Eds.), Friendship and peer relations. New York: John Wiley and Sons, 1975.

1. Summary: In order to understand peer relations in a comparative context, Konner asserts it is necessary to:
 - a. Describe conditions under which natural selection would favor them.
 - b. Review similar relations in other mammalian species.
 - c. Consider peer relations in relation to what is known about man's evolutionary environment.
 - d. Trace changes that peer relations have undergone as the environment has changed.

Konner suggests that there are a number of ways in which peer relations would be favored by natural selection. Natural selection would favor alloparental (or "aunting") behavior by juveniles. If the alloparent was related genetically to the recipient of the parenting, it would increase the viability of the genes of the alloparent, thus preserving the practice. It could also provide practice useful for later parenting. Play relations among unrelated individuals could be favored because they provide practice for sexual and agonistic behaviors that are important to later reproductive success. Relations among relatives are also favored for the additional reason that they permit the learning of useful information.

All of the characteristics of peer relations, particularly those related to alloparenting and teaching, would be more characteristic of multi-age groups than strict peer groups (children of almost the same age are considered peers).

Among non-human primates there are three patterns of social relations that are prevalent: juvenile alloparental behavior is common, usually engaged in primarily or exclusively by females. Among primates which live in large groups, play groups of distantly related juveniles are frequently found. Sibling play groups are common in all the apes and among a number of other primates. Peer groups in the Western sense of a school "grade" are not found among non-human primates.

Peer groups are also unlikely among hunting and gathering groups, because the low population density associated with hunting and gathering would make the existence of enough children of approximately the same age to form a group unlikely. Konner estimates that 99 percent of human generations were part of hunting and gathering groups, so he suggests that peer relations cannot be considered to be a species-characteristic of homo sapiens.

Konner notes that a number of infant peer relations characteristics seem bizarrely inappropriate, with examples being parallel play and collective monologues. He suggests that this can only be understood by realizing that human beings did not evolve for peer relations at all, and that peer relations only exist in industrial societies and laboratories. He concludes that "infants are inept at relating to one another for the simple reason that they were never called on to do so during millions of years of evolution."

2. Major implications for a definition of teaching: To the extent that there is an evolutionary model for teaching, teaching should occur when it leads to an increased likelihood of both the teacher and the taught surviving to have viable offspring because of the teaching and learning that occurs. This situation is most likely to arise when the teacher and the taught are genetically related, since then an improved viability on the part of one would in itself constitute improved viability for the other. Using Konner's criteria, the conditions under which natural selection should favor the development of teaching would be under conditions where the teacher and the taught are genetically related, as in parents teaching their offspring or older siblings teaching younger siblings. Even if teaching only arose under conditions in which parents taught their offspring, this could be expected to lead to teaching of younger siblings by older siblings, since it would constitute practice for the older siblings in the role of parenting.

Using this line of reasoning, one might expect that particular kinds of teaching (e.g., tutoring of younger children by older children) would be relatively easy to effect.

Konner also asserts that age groupings of children, as in most classrooms, are not typical of human experience during the course of evolution. Accordingly, many of the problems that occur in such classrooms could be attributed to the fact that human beings did not evolve for such settings. Konner's article raises the possibility that multi-age classrooms, in which older children play a role in teaching the younger children, would be a closer approximation to the conditions to which human children have adapted than are current classrooms, thus possibly being more effective.

3. Major implications for studying teaching: Konner would suggest that in order to fully understand human teaching, it is necessary to study teaching as it occurs in other societies, particularly ones which still resort to a hunting and gathering mode of existence, as well as teaching that occurs in other mammalian species.
4. Categories: Konner uses a relatively strict definition of a peer, limiting "peer" to a child born within 18 months of another child.
5. The nine elements:

1. Students: Human children are biological organisms, whose behavior reflects in part the evolutionary pressures which have been placed on the behavior of previous generations of children. Part of this

pressure appears to be the ability to successfully take part in a mixed multi-age group of children; the ability to relate to children of the same age does not appear to have been an important ability for young children to have in pre-industrial societies.

2. Teachers: As part of a multi-age group of children, older children should often have played the role of teaching the younger members of the group. Thus, older children should have some potential promise as teachers. Teaching itself probably developed under conditions in which the teaching led to increased viability of both the teacher and the taught; this might well have originated in the situation in which a parent taught his or her offspring. If this is the case, whatever biological model of teaching there may be would be similar to the teaching aspects of a parent/child relationship. Teaching may draw on the fact that children may come preadapted to a student role in their relationship with their parents.

3. Other human elements: Not relevant.

4. Role: To the extent that there exists a biological role of student and/or teacher, it should have evolved under conditions in which the role activities led to increased viability on the part of the teacher and the taught. Since modern classrooms have not existed for a very long period of time, in evolutionary terms, the biological aspects of such roles would have had to develop in other relationships than between the child and an adult employed as a teacher in a school. Such a model might be found in the relation between younger children and older children in a multi-age play group, as well as in the relations between a child and his or her parents, and between the child and other adult relatives.

5. Time: Not relevant.

6. Place: Not relevant.

7. Task: Not relevant.

8. Standards and sanctions: Standards of behavior and effective sanctions may have their origins in the evolutionary history of human beings as it is related to teaching and learning. This possibility suggests that it may be important to study the standards of behavior and the sanctions employed in situations in which parents teach their offspring, and in cases where older children teach younger children.

9. Communication: Methods of communication would have evolved when and if they were of benefit to both organisms involved in the communication. If, as suggested, it is the case that teaching is related to the relationships between parent and child and between older and younger children, it would be worthwhile to explore the kinds of communicative behaviors that occur during these relationships.

Source: Lorenz, Konrad. Behind the mirror. New York: Harcourt Brace Janovich, 1977. (Originally published, 1973.)

1. Summary: The subtitle of the book is "a search for a natural history of human knowledge," and represents an attempt to trace human knowledge, learning and culture to their evolutionary origins. Lorenz views life quite literally as a process of learning, such that "life is an eminently active enterprise aimed at acquiring both a fund of energy and a stock of knowledge, the possession of one being instrumental to the acquisition of the other." Adaptation is an increment in the transinformation between the organism and the environment (in terms of information theory terminology), this change occurring through processes in the organism without any perceptible change in the environment.

Lorenz suggests that the process of evolution is saltatory rather than gradual, reflecting what he terms "fulguratio" or "the creative flash" by which qualitative changes in organization occur which result in an improved adaptation. He concludes that "each step forward has consisted of a fulguratio, a historically unique event in phylogeny which has a chance quality about it."

In terms of information theory, Lorenz describes a series of different mechanisms and provides examples of the exploitation of information about the world for the purposes of adaptation. He notes that the genome itself has almost unlimited capacity to store information, but it is not in itself sufficient to lead to adaptation due to its inability to cope with any rapid change in the environment, since its response time is in units of generations. He notes that there are a great many well-adapted behavior mechanisms which acquire and exploit information but do not store it. Examples are all negative feedback mechanisms, as in amoeboid movement away from an irritant. Such short-term information gain is also implicated in some fixed-action patterns, as in the innate releasing mechanism that causes the common tick (Ixodes rhicinus) to bite (the tick bites everything that has a temperature of 37 degrees C and smells of butyric acid). Such mechanisms are released in the simplest possible way without incurring too much danger of the behavior pattern being released by anything other than the biologically adequate situation.

More complex learning processes appear on first inspection to constitute an opposed process to that of genetic determination of behavior patterns. Lorenz suggests that in fact this is not so, but rather that learning occurs at particular points where it will be likely to have an adaptive function. He suggests that random learning is as unlikely to produce positive consequences (as learning generally does) as would random tinkering with the engine of an automobile. Learning occurs at points for which there is an "open programme," which has the capacity to absorb further information from outside by allowing this information to determine which of the available possibilities shall be realized.

Another manner in which learning is structured by innate characteristics concerns the functioning of innate teaching mechanisms, or the "innate schoolmarm" of appetites and aversive responses which lead an organism in the directions likely to be adaptive.

Lorenz also points out the importance of a particular type of adaptation, what he calls "specialists in non-specialization." These consist of rats among the rodents, corvidae among the song birds, and man from among the primates. Only such nonspecialists can become cosmopolitans, because their versatility enables them to adapt to a variety of environments much more quickly than other organisms can. Lorenz also notes that all of these "specialists in nonspecialization" are characterized by much stronger exploratory behavior than are comparable related species. Motivationally, Lorenz suggests that exploratory behavior is motivated by the learning process itself rather than by the achievement of the final consummatory state, and this intrinsic motivation is sufficient to ensure continuance of exploratory behavior even in the absence of other drives.

Another important characteristic of human exploration is that of behavioral neoteny, the persistence of childish characteristics of curiosity and exploration into adulthood.

Lorenz refers to human language and human conceptual thought as a "fulguratio" or creative leap, and he asserts that it has the consequence of making acquired characteristics heritable, which is an advantage over the genome.

Lorenz refers to the process by which culture changes to be a combination of love for tradition and curiosity, analogous to the way in which osteoclasts and osteoblasts work against each other in the creation of bone structure. He refers to the biography of Helen Keller to speculate that "at a particular stage in his childhood man has an overwhelming urge to put names to things, and feels a great sense of satisfaction when he succeeds in doing so. The second is that, notwithstanding the strength of this urge, he does not attempt to invent his own names, like Adam in the book of Genesis, but knows instinctively that they have to be learned, i.e., acquired from contact with tradition. The learning of language is therefore based on a phylogenetic programme which ensures that the child's innate power of abstract thought is integrated and reintegrated on every occasion with the vocabulary that belongs to its cultural tradition. This is a miracle of creation which cannot fail to fill us with a sense of awe and reverence every time we have the opportunity of witnessing its repetition in a young child."

2. Major implications for a definition of teaching: Given the nonspecialization of human beings, Lorenz conceives of human development as an "open programme" choosing from a large number of possible phenotypes envisioned by the human species genotype. Lorenz believes that the goal of life is the acquisition of a fund of energy and a stock of knowledge. Human infants have a great deal to learn in order to become human adults, and teaching is designed to facilitate their later ability to survive as human adults and produce viable offspring.

Human education is even more complicated, because human beings contain two different tendencies, one tending towards lavish and conservative devotion to existing institutions and customs, the other towards curiosity and exploration, which tend to undermine and destroy these cul-

tures and customs. Lorenz suggests that there is a healthy balance between these two tendencies, which has the implication that successful education must maintain a balance between overwhelming the young with facts and the successful accomplishments of generations past, and leaving them on their own to explore and develop on their own.

3. Major implications for research methodology: As a naturalist, the student of education must study education as it actually occurs in human environments, as well as analogs to education that occur in other species. In doing so, he should be guided by the theory of evolution, and the understanding that existing species and behavior patterns are those that have proved to be adaptive over the course of time.
4. Categories: Rather than opposing learning to genetically-determined behavior patterns, Lorenz notes that learning occurs at particular places where it turns out to be useful. From this he concludes that there must exist innate teaching mechanisms, or an "innate school-marm," which "give the young organism a 'gentle hint' as to the direction in which its efforts are likely to be most successful."
5. The nine elements:
 1. Students: Students are biological organisms with open-learning programmes. They have a number (and as humans, a large number) of possible adult phenotypes they could become, with their genetic endowment providing no more than a "gentle hint" as to the basic kinds of learning that have been most useful in the past.

Lorenz notes that "man's extended childhood enables him to learn--that is, to fill his mind and his memory with the accumulated knowledge of tradition, including language. The equally extended period between puberty and adulthood--youth--also has its specific role. It seems a natural development, rooted in the phylogenetic pattern of human social behaviour that young people who reach the age of puberty should challenge the traditional values they have inherited from their parents and look for new ideals." Thus students have a difficult process of both learning cultural traditions and learning how to challenge them.
 2. Teachers: Teachers play an important role as guardians of the culture's traditions, instilling cultural beliefs and knowledge in the next generation. Teachers must also deal with the propensity of their students for both accepting and rebelling against these traditions and beliefs.
 3. Other human elements: Not specifically relevant.

4. Role: Lorenz comments on the propensity of cultures for producing large numbers of increasingly static and rigid roles and suggests that this process might lead to a reaction against them which accounts for the decline of "high" civilizations in a Spenglerian sense.
5. Time: This is important in terms of ontogenetic time; Lorenz emphasizes the importance of critical periods for the learning of particular kinds of behavior patterns and integrations (stemming from his work on imprinting in precocial birds).
6. Place: Not specifically relevant.
7. Task: Learning is conceived of as the developmental task of young children.
8. Standards and sanctions: Generations of human adaptations have led to the incorporation of basic standards and sanctions in the genome, which by a combination of appetitiveness and aversiveness lead humans in directions likely to be useful, functioning as an "innate schoolmarm" to facilitate the task of its colleagues.
9. Communication: Both species-typical genetic characteristics and the conservative nature of cultural transmission facilitate communication by ensuring that human beings within a culture are likely to share the same verbal and nonverbal languages, and nonverbal communication is reasonably consistent across different cultures (and to some degree, across species).

--Reviewed by Kevin Miller

Source: Neill, S. Aggressive and non-aggressive fighting in twelve- to-thirteen year old pre-adolescent boys. Journal of Child Psychology and Psychiatry, 1976, 17, 213-220.

1. Summary: The objective of the study reported in this article was to discover whether the distinction between rough-and-tumble play and true aggression becomes difficult to make when observing young adolescent boys. This question was investigated as an extension of Blurton-Jones' (1972) studies of young children and of Hinde's (1974) study of aggression in adolescent monkeys.

The playground behavior of 12- to 13-year old boys was observed, and the data (categories of behavioral events) were subjected to a factor analysis. The results indicated that approximately 20 percent of the variance was accounted for by four factors that did not have loadings for fighting actions. They were: football, quiet social; throwing games; active social; and move/touch. Two factors emerged that were of primary interest. Factor Two which accounted for about 8 percent of the variance was called rough-and-tumble. In Blurton-Jones' study, rough-and-tumble play did not include truly hostile behavior, but in the present study, Factor Two included some elements of hostile behavior. Behavioral units which loaded on this factor were: strangle, wrestle, push, handwrestle, grab, beat, attacked, chase, and climb. Factor Four included behavior that indicated low intensity fighting and gentle sparring without much body contact. Behavioral units which loaded on this factor were swing hit, fend, tough, beat, ritualized, hand wrestle, and touched.

The behavior of individuals was also analyzed. Although the author does not discuss this analysis in detail, he mentions that it was found that individuals tended to fight in characteristic ways. Two styles of fighting were identified in relation to Factor Two and Factor Four, respectively.

3. Major implications for studying teaching: The observational method used in this study would seem to be useful in studying a variety of social interactions among children at play. In most schools, an observer could easily find a place in which to record playground behavior unobtrusively. The high proportion of salient, non-verbal behavior displayed in play situations would simplify the problem of defining behavior categories.
4. Categories: A hostile act is defined as one which evokes reactions from others which imply that it is damaging, e.g., protests, retaliation, crying. Rough-and-tumble play is defined as in Blurton-Jones.
5. The nine elements:
 1. Student: The finding that older boys (in contrast to the young boys studied by Blurton-Jones) display fighting behavior that seems to be a mixture of aggression and rough-and-tumble

play raises questions about the causes of such a qualitative change in behavior patterns. The author suggests that an increase in levels of testosterone may cause an increase in aggressive behavior. Also, since older boys are stronger, they are more able to inflict injury on each other and may have to reduce the amount of fighting that they typically engaged in when younger in order not to hurt each other. Since all boys in the study did not engage in the behavior accounted for by Factor Two, the role of individual differences in display of aggression must be considered in addition to age.

4. Role: Fights are interpreted as one means by which dominance relations may be asserted. In rough-and-tumble play between a pair of boys in which one is clearly stronger than the other, the stronger boy may increase the intensity of the fight until the weaker boy shows pain and then resume fighting in a more playful manner. Among less assertive boys, the avoidance of sparring attacks may be sufficient for the showing of submission. The distinction between aggression and rough-and-tumble play may persist among such boys.

9. Communication: This study raises the question of how aggressive fighting is incorporated into the behavioral repertoire such that it is mixed with rough-and-tumble play. One suggestion is that as children grow older, they begin to initiate hostile behavior as well as rough-and-tumble play. No evidence in support of this hypothesis is provided, however.

6. Description of the study:

- a) Behavior: The natural behavior of approximately 34 boys as they played outdoors on a school playground was observed.
- b) Setting: The playground consisted of a blacktop area and playing fields which were fenced in.
- c) Treatment: See item #1 for lists of behaviors which were included in the factors studied.
- d) Data collection: Observations were taken from a first floor window looking out onto the playground and binoculars were used in order to see facial expressions. The observers tape recorded a running commentary of behavior. Twenty 2-minute recordings were made for each boy and each individual was observed only once per day.
- e) Data analysis: A factor analysis was undertaken in order to separate rough-and-tumble play from aggression.

Source: Omark, D. & Edelman, M. The development of attention structures in young children. In M. Chance & R. Larsen (Eds.), Attention structures. N.Y.: J. Wiley, 1976.

1. Summary: It is proposed that the development of logical structures (described in Piaget's theory) limits and structures the child's Umwelt in ways that are important to adaptation. The Umwelt should reflect the ability to recognize objects or individuals that are necessary for survival during a particular stage. Children need to recognize conspecifics (members of their species) and roles, defined as tasks that are of some consequence for the survival of the group, and, within certain biological limits, could be performed by any member of the group. Specifically, accurate perception of a dominance hierarchy is important for survival because it tends to help children avoid potentially damaging fights and other types of conflict. Two stages of the development of a recognition of dominance hierarchies are described within Piaget's theory.

1. At the stage of preoperations, children's responses to questions about dominance relations are based on their immediate perception of size and other physical characteristics and on their immediate feelings with respect to themselves and the other person.
2. At concrete operations, the child is able to organize previously observed dominance relations into a coherent system.

Thus, in the study presented in this chapter, it is hypothesized that there will be a large percentage of agreement on who is the toughest among preschoolers. Based on the idea that the social group is crucial to the survival of the human species, the authors suggest that cognitive structuring of social objects "will be earlier, stronger, and more important than are the children's responses to physical objects." (p. 147) They suggest that each type of cognitive organization should be looked at as being important for survival at that time, not just as a step leading toward the development of more complex structures.

One important effect of attention structures is that they focus children's attention on characteristics other than toughness in the dominant individuals. Thus, other characteristics, such as intelligence, become important in dominance interactions.

3. Major implications for studying teaching: The method involved direct questioning of children and also included use of paper-and-pencil tests. Please see section 6 for a description of procedures used in the reported study.
4. Categories: An Umwelt of an organism is defined as "that portion of the total environment of which the organism has some awareness through its sensory organs." (p. 121)

6. Description of the study: Four different tests were administered in the study. Three of them required the child to order pairs of their classmates on the following dimensions: toughness, niceness, smartness, and having the most friends.

The Photograph Hierarchy Test was administered individually. The child was shown photographs of everyone in his class, was asked to show that he understood what tough, etc. meant, and then was told, "Now let us look at the first child in the row. If the child is tougher than you, turn his picture over." (p. 129) This was repeated with each picture.

First graders were given the Cluster Hierarchy Tests in which randomly chosen clusters of names, including "me" were listed on paper. The children were asked to order the names by connecting the number one to the toughest child's name, number two to the next toughest child, etc.

Some children were given the Complete Hierarchy Test, which was similar to the Cluster Tests but included names of all class members on one list. Only the dimensions toughness and smartness were investigated with this test.

A smaller sample of children took the Cognitive Test of Hierarchization which consisted of two parallel forms. One form dealt with people and required the child to rank 8 photographs of children in the class according to toughness and then answer questions about a hypothetical child's position in the hierarchy. The other form dealt with colored sticks, asking the child to order them by length and then order a perceptually shorter stick that was said to be longer than the longest stick when actually measured.

The data analysis examined how pairs of children perceived each other and in turn were perceived by their classmates. In order to estimate dyadic agreement, which measures the strength of a hierarchy, the number of "dyads of established dominance" was calculated for each dimension. In addition, a measure of accuracy of perception of others in the hierarchy was taken. (See Edelman & Omark, 1973) The direction of attention was examined by "seeing if there was less variance in agreement about who was rated highest in the hierarchies as contrasted with the variance of those lowest in the hierarchies." (p. 129) Degree of emotional involvement in the hierarchy was assessed by comparing an individual's self-placement in various dyads with the class's placement of him or her.

The results of the study confirmed the hypotheses that: 1) perception of a dominance hierarchy would develop concurrently with the ability to perform the logical operation of transitivity 2) the greatest amount of attention would be directed to the individuals at the top of the hierarchy and 3) children would show more effective reasoning about

Review of Omark & Edelman (1976), pg. 3

relationships involving individuals at the top of the hierarchy than at the middle or bottom. One other important finding was that there were no sex differences in accuracy of perception of dominance.

--Reviewed by Susan Frey

Source: Plutchik, R. The study of social behavior in primates.
Folia Primatologica, 1964, 2, 67-92.

1. Summary: In a discussion of the study of social behavior in animals, the author points out the need for examining complex social interactions in order to generalize findings to humans. The problems involved in studying complex social behavior are than outlined.

First, general problems of primate research are discussed. In a brief review of research, the author notes that most primate studies are incomplete in that not enough different species are included in comparisons and the species that are studied are not observed under enough conditions. A second problem is that investigators tend to try to make generalizations about a given behavior without taking into consideration the relative frequency of the behavior in an individual's repertoire. Third, different authors have different ways of defining the same type of social behavior. For example, dominance may be defined in terms of food-getting behavior in one study and in terms of aggressive control of others in another study. Plutchik points out that two such behaviors may not even be highly correlated. A fourth problem concerns the limitations of using ordinal scales. (See discussion of chapter 1 of Hutt and Hutt.) Lastly, the problem of making inferences from behavior is discussed. Investigators often want to talk about a general, higher-order category of behavior on the basis of their observations of molecular events. But, for example, one has no simple, direct means of knowing whether a specific type of sexual behavior indicates a sex drive or a display of dominance.

After reviewing several different systems of categorizing animal behavior (see item #2), Plutchik goes on to discuss problems of sampling behavior. He mentions six observational sampling methods which are taken from Wright (1960). They are the following:

- a. Diary descriptions (cf. Altmann's Ad Libitum Sampling)
- b. Specimen descriptions--these are diary descriptions of a particular context over a short time span.
- c. Time sampling (cf. Altmann's Scan Sampling)
- d. Event sampling (cf. Altmann's All Occurrences of Some Behaviors)
- e. Field unit analysis - a modified time-sampling method
- f. Trait rating - a weighted average of impressions.

Finally, the problem of assessing inter-rater reliability is considered. (See review of Hollenbeck for a more up-to-date discussion of this problem)

2. Major implications for a definition of teaching: One of the points brought out in this article is that studies of social behavior of animals should be as generalizable across species as possible. In particular, investigators should try to use behavior categories that are relevant in studies of many different animals. Two behavior

classification systems are discussed. The first (Scott, 1958), divides an animal's repertoire into the following behavior categories: ingestive, agonistic, shelter-seeking, sexual, investigative, care-soliciting, care-giving, eliminative, and allelomimetic. In this system, teaching might be defined in terms of the different types of behavior involved. The categories investigative, care-soliciting, care-giving, and allelomimetic behavior seem to be most relevant to teaching and learning. The second category system (Plutchik, 1962) is based upon Scott's scheme and includes the following categories of behavior: incorporation, destruction, reproduction, orientation, exploration, deprivation, protection, and rejection. The teaching-learning process might be viewed as consisting of some behavior in the categories incorporation (of knowledge), reproduction in the sense of imitation, exploration, orientation, and protection. Defining teaching in such a way may help researchers make use of the findings from primate and other animal literature in understanding some facets of school-related behavior.

3. Major implications for studying teaching: The article includes a few direct suggestions for making use of behavioral categories. They should be theoretically meaningful, exhaustive enough so that every behavior can be categorized, relatively few in number and reliable.
4. Categories: Social behavior is defined as "What one gets when the behavior of one or more individuals can be shown to be a function of the behavior others" (p. 67, taken from Baron and Lieberman, 1961).
5. The nine elements: The author includes a list of social behavior variables which he thinks are important to study. They will be discussed here in relation to the relevant elements. Two variables that should be studied in relation to student are (a) sex differences, e.g., in vocalizations, gestures, status positions; and (b) the influence of early experiences on later behavior. Three variables are mentioned that relate to role. They are: (a) social facilitation of behavior (the author refers to animal feeding behavior but this could be identified in humans as performing certain tasks); (b) parasitic relationships between pairs of individuals in working situations and variables affecting the development of such relationships; and (c) dominance hierarchies. School materials could be studied in terms of their tendency to elicit manipulation. Lastly, behavior indicating affection, such as body contact and clinging, and behavior such as peer teaching can be studied as part of communication.

--Reviewed by Susan Frey

Source: Prost, J. Varieties of human posture. Human Biology, 1974, 46, 1-20.

1. Summary: The main point of this paper concerns the methodological task of creating behavioral taxonomies. The "behaviors" discussed are human postures. Although an educational researcher may want to include an accurate description of posture in a behavior category, the posture itself will most likely not be the central organizing feature of the category. Thus, the procedure outlined in this paper may have limited application to classroom studies.
4. Categories: Two models for classifying postures are described. The discrete, topological, or language model assumes that postural types are centers of non-overlapping groups. The weakness of using a discrete model to label "field phenomena" or phenomena that occur on a continuum is revealed when trying to classify intergrading cases. By forcing such cases into types, relations between variants become distorted. The other model, the field model, "postulates a continuous field of phenomena, within which intermediates occur between any two points." (p. 1)
6. Description of the study: A study was conducted to see whether posture could be called a field phenomenon. Pictures showing 590 different poses were taken from magazines and subjectively categorized using common language terms. Postural configurations were analyzed using two kinds of data. Contact data indicated relations between body parts and the environment, e.g., they provided information such as "feet touching the floor." The segments of the body considered were: hand, lower arm, upper arm, lower leg, upper leg, head, neck, rib cage, midsection, and pelvis. Each body segment represented a variable and although the combinations of contacting parts correlated with subjective labels for the photographs, the possible combinations of body segments far exceeded the available subjective labels. Body display data consisted simply of displays of body parts. A globographic method was used to record motion ranges for human joints. In a drawing of a human figure, the positions of various bones were assessed and locations of joint centers were determined. The six joints considered were: shoulder, elbow, wrist, hip, knee, and ankle. Circles were drawn to indicate the maximum theoretical range of the joint positions. Variables represented by equatorial circles at shoulder, elbow, wrist, hip, knee, and ankle had a range of 0° - 360° . Variables represented by meridional circles at each side of the shoulder and hip ranged from 0° - 180° . To measure the angles, the researchers either used protractors or simply guessed. After the postures in photographs were analyzed, a live subject assumed the poses depicted in the photographs. Globographic data were taken for the live subject and were found to match the data from pictures within 5° . Modes were calculated for the hip, shoulder, and other joints. The authors suggested that the modes are "responses to anatomical dependencies, biochemics of balance, and efforts at closure." (p. 12) (Closure exists when limbs are in rest positions, e.g. arms crossed.) The authors emphasized that being able to record the full range of postures is important, since modes may

Review of Prost (1974), pg. 2

"hide the real postural variety." (p. 12)

--Reviewed by Susan Frey

Source: Reynolds, V. The origins of a behavioral vocabulary: The case of the Rhesus monkey. Journal for the Theory of Social Behavior, 1976, 105-142.

1. Summary: In an effort to construct a standard behavioral vocabulary for the Rhesus monkey, the author compares the behavior units and definitions that were formulated in different studies. In so doing, he encounters many problems in trying to determine the accuracy of the different records of behavior. His presentation of (a) factors which may account for similarities and differences among different category systems, and (b) various ways in which behavior elements can be grouped into categories is succinct and seems to be relevant to ethological studies of humans.
3. Major implications for studying teaching: When comparing different studies of the same type of behavior, one can consider the following factors which may help clarify ways in which descriptive terminologies relate to one another and to the behavior they are meant to describe.
 - A. Aims - These limit the focus and determine the type of sampling used. They also promote different amounts of lumping and splitting.
 - B. Lumping and splitting - This may be done differently from study to study in spite of similar aims.
 - C. Prior sources - Often authors refer to the same published studies.
 - D. Word usage:
 1. dialect - this may determine, for example, which of many synonyms is used.
 2. translation differences
 3. linguistic competence - in expressing what one sees.
 4. observer's academic background
 5. implicit social theory
 6. principles of naming - these include structure, function, motivation, and context.
 - E. Access to subjects:
 1. distance - the greater the distance, the more inclusive the categories and the greater the tendency to include less fine detail and more ecological information.
 2. technological aids - e.g., motion pictures can capture more detail than can be described in words.
 - F. Inadequacies and mistakes

Review of Reynolds (1976), p. 2

The following are different ways in which elements can be grouped into categories:

1. sequentially
2. chronologically - showing occurrence within the same time span
3. morphologically - referring to the same body part
4. sensory - involving the same sense modality
5. functionally - having a common effect
6. ontogenetically - occurring in a developmental sequence
7. causally - linked by external or internal causes
8. evolutionarily
9. contextually - occurring in the same situation

-- Reviewed by Susan Frey

Source: Rosenblum, L. The creation of a behavioral taxonomy. In G. Sackett (Ed.), Observing behavior (Vol. II): Data collection and analysis methods. Baltimore: University Park Press, 1978.

3. Major implications for studying teaching: The author considers the problems of defining a behavioral unit:

1. When the beginning and end of a behavioral unit are not discrete, one can define the unit by deciding what behaviors are tightly clustered. To determine the beginning of the unit, identify what is the salient point of interest with respect to the research question.
2. Should location be included? The author suggests that if a behavior always seems to take place in a particular location, the location should be included in the definition.
3. In handling variations in intensity, speed, and force, one should ignore such differences unless they seem qualitative.
4. Should "extra" elements be included? They do not need to be included if they seem to be independent of the basic pattern.
5. In order to set boundaries between behavioral elements, one can use a shift in level of motoric output or a shift in the focus of the senses, e.g., visual orientation.

The author considers ways to organize a taxonomy:

1. Functionally organized taxonomies can deal with individual differences and can handle many behavioral units. Often many observations are needed before accurate classification of behaviors by function is possible; this could pose a problem.
2. One can organize behavior around the actor or receiver of the action being studied. The author notes that the receiver of action can be a part of the environment or a social partnership in addition to an individual.
3. Behavior can be organized in terms of a major muscle group or motoric elements involved in expressing a behavior. Organization at this level is most likely not useful in most classroom observational studies.

--Reviewed by Susan Frey

Source: Sackett, G. Measurement in observational research. In G. Sackett (Ed.), Observing behavior (Vol. II): Data collection and analysis methods. Baltimore: University Park Press, 1978.

3. Major implications for studying teaching: First, sampling techniques are described. It is assumed that the observer has available a coding system for behavior, inter-observer reliability scores, and observation sessions with known length.
 1. In continuous real time measurement, every frequency or duration of behaviors is recorded within a session. In order to adjust for different session lengths, one calculates rates. To ensure that the behavior sample is representative, the observer must make sure that the session is long enough.
 2. Discontinuous probe time sampling consists of instantaneous recording at the end of set time periods. In order to solve the problem of how to interpret context-dependent behaviors, one could take probe samples for a length of time at the end of the sessions to record ongoing activity. One could also record ongoing activity after some specific event, such as a teacher desist.
 3. Modified frequency time sampling is what Altmann (1974) called one-zero sampling. Behaviors are scored only once per interval regardless of how many times they are observed in order to get a modified frequency (MF) score. The advantages of this method are that only a pencil, data sheet, and time-keeping device are needed; it requires less concentration than real time measurement; inter-rater reliability scores are higher. Disadvantages include the following: the method is insensitive to detecting infrequent behavior, it fails to provide an accurate estimate of the total time spent in a behavior, and it does not provide sequential data.

Second, a type of sequential analysis is described. Lag Sequential analysis is proposed by Sackett as an alternative to using Markov chains. "The method measures the number of times behaviors of interest follow a selected behavior at various lag steps removed in the ordered data." (p. 39) A lag is defined as the "number of event (or time unit) steps between sequential events." (p. 39) Behaviors of interest are called criterion categories and behaviors looked for at lagged steps from the criterion are matching categories. Briefly, the method involves filling out a frequency-of-match table by counting the number of times a match follows and precedes the criterion behavior at various lags, e.g., 1,2,3,4. One can transform frequency data into lag conditional probabilities by dividing each matching frequency by the total number of occurrences of the criterion at each lag step. Then, one can assess statistical significance by testing lag probabilities against unconditional (overall) probabilities. This method of sequential

Review of Sackett (1978), pg. 2

analysis is much less time-consuming than using Markov chains.

--Reviewed by Susan Frey

Source: Sackett, G., Ruppenthal, G. & Gluck, J. An overview of methodological and statistical problems in observational research. In G. Sackett (Ed.), Observing behavior (Vol. II): Data collection and analysis methods. Baltimore: University Park Press, 1978.

3. Major implications for studying teaching: Although recognizing the problems involved in relying on human observers to measure behavior, the authors stress that human sensory, perceptual, and judgmental skills are the most effective means by which we can get information about complex behavioral-environmental interactions. In addition to providing brief statements about topics that are discussed in other chapters, the authors make the following recommendations to researchers using an observational approach:
 1. Given that the goal of observation is to obtain representative samples of behavior, one should measure both frequency and duration of behavior whenever possible.
 2. In sequential analysis, one should use a statistical approach--letting sequences reveal themselves--rather than using a definitional approach, in which sequences are used to identify categories of behavior. The definitional approach gives the observer expectations as to how the behaviors will covary, thereby creating a source of observer bias. The statistical approach avoids this problem and provides a means of handling sequences.
4. Categories: Two kinds of taxonomic systems are defined. A molecular system defines categories of specific motor actions, postures, or gestures. A molar system defines generic classes of behavior at a higher level of abstraction, e.g., play, exploration, aggression. Classes can be formulated in terms of the function or outcome of actions.

--Reviewed by Susan Frey.

Source: Savin-Williams, R. Dominance and submission of boys during early adolescence. In D. Omark, D. Freedman and F. Strayer (Eds.) Dominance relations: An ethological perspective on human conflict, in press.

1. Summary: A series of investigations of the structure of interpersonal relations in adolescent boys is presented. The dominance hierarchy that emerged in the study was stable and was formed very quickly after the boys gathered as a group. The author suggests that the function of the dominance hierarchy is to provide stability and predictability to group living, as it does in primates.
3. Major implications for studying teaching: The author used an interesting means to obtain observational data on adolescent behavior: he served as a camp counselor and was able to record behavior inconspicuously in his role. He used the sampling technique, All Occurrences of Some Behaviors (Altmann, 1974) to record behavior of members in his cabin group. He also collected sociometric data, information from camp records, and administered standardized tests. Details of the methods are given in section 6.
4. Categories: See section 6 for definitions of behavioral categories.
6. Description of the study: The author recorded all occurrences of social dominance that were observable in each of three cabin groups during 5-week periods in the summers of 1973, 1974, and 1975. Each group contained 6 boys who were between the ages of 12 and 14 and were from upper-middle class, suburban backgrounds. The camp was located in a natural forest area of northern United States and offered activities such as athletic games, water sports, overnight camping, crafts, cabin discussions, and religious services.

Social dominance behavior was recorded in the following categories, which are taken verbatim from pages 2-3 of the chapter.

1. Verbal directive: X verbally communicates to Y what to do and Y complies,
 - a. direct order or request
 - b. indirect directive or suggestion of behavior
 - c. giving unsolicited advice or information
2. Verbal ridicule: X raises his status or lowers Y's status by verbally abusing Y or by putting himself in a good light at the expense of Y. Y does not contradict usually withdrawing from further interactions.
 - a. name calling, teasing by direct confrontation
 - b. talk about, verbal put-down, gossip, cattiness--usually by a third person
 - c. bragging or boastful behavior
3. Physical assertiveness with contact: X pushes, shoves or hits Y. Y takes a submissive posture, flees, or if asserts back in turn, loses.

4. Recognition: Y acts in such a way as to place X in a more powerful position. X becomes a social monitor for Y.
 - a. imitation or modeling behavior, appearance, speech, agree with
 - b. ask for approval of behavior or appearance; to apologize
 - c. give compliments; give favors; ask where is; defend
 - d. ask or solicit information or advice; divulge information, wait for
5. Physical or object displacement: X takes an object away from Y, or X approaches and Y moves away.
 - a. direct removal or supplantation
 - b. indirect control; not asking to borrow, moving into space
6. Verbal or physical threat: X asserts verbal or physical authority over Y with Y not countering.
 - a. verbal challenge, usually with threat of bodily harm
 - b. physical challenge without making actual physical contact; glaring
7. Counter dominance: X, commanded by Y, assertively or passively disobeys and Y does not pursue the demand.
 - a. ignoring a direct order or request
 - b. ignoring the other; shunning; spatial exclusion
8. Verbal control: X verbally argues or battles with Y and gets the last word in or monopolizes the content and structure of the verbal interaction.
 - a. argument or battle; direct refutation
 - b. monopolizes a conversation; interrupts the other's speech
 - c. contradictions without anger; corrections.

The sociometric data consisted of the following: questionnaires asking all cabin members to rank each other in order of toughness or dominance and to rank the cabin members according to how much they liked them, and a characterization exercise in which each of the boys chose one member of the group who was best described by certain adjectives. Standardized tests were given to measure creativity and intelligence. Additional measures included measures of physical fitness, size, pubertal maturation, leadership, hiking position, age, and bed position (distance of each boy's bed from the counselor's bed).

In order to assess dominance structures, the behavioral indices were tested for relatedness, and since they were highly correlated, they were combined into a general score to describe dyadic dominance. The dominance orders were obtained by arranging members of a cabin according to the number of cabin mates significantly dominated during the five weeks of data collection. The binomial probability

Review of Savin-Williams (in press), pg. 3

distribution was used to test for significance.

The behavioral indices of dominance were found to correlate highly with a composite group ranking obtained from the sociometric measures.

Spearman rank correlations were computed for the other measures of dominance and revealed that atheletic ability, bed position and leadership were significantly correlated with the behavioral hierarchy

--Reviewed by Susan Frey

Source: Smith, P. Temporal clusters and individual differences in the behavior of preschool children. In R. Michael and J. Crooks (Eds.), Comparative ecology and behavior of primates. New York: Academic Press, 1973.

1. Summary: Different kinds of information about behavior is supplied by studying inter-individual differences in behavior over time (personality differences) and temporal relations of behaviors, or motivational clusters that vary over time. Peter Smith collected observational data on children in a preschool program, and analyzed the data in both of these traditions, to determine the relation between the kinds of factors that emerge in these two different kinds of analysis. Behavioral categories referenced simple behaviors capable of reliable inter-observer agreement between the observer and another observer working solely from the written definitions of the categories (without any special training in the observational technique).

Smith performs a factor analysis on the resulting data to investigate individual differences in behavior patterns. He evaluated the reliability of the resulting factors by performing a split-third factor analysis (3 separate factor analyses on subsets of the data), and comparing these subsets with the entire set of data. Adequate reliability was found for principle components method factors labelled as social maturity (Positive ratings on social interaction behaviors, negative or withdrawing behaviors such as cry or automanipulate), and toy-manipulate (positive loadings on categories involving toy manipulation, negative loadings on behaviors such as slide or chase/flee which do not involve toys).

Analysis of temporal clustering of behavior found clusters of: active play not involving toys (with subclusters of non-contact play, contact play and play involving immovable apparatus), dependency behaviors (crying, sucking), behavior oriented toward adults, stationary play, and agonistic behavior.

The relations between the individual difference factors and the temporal clustering was somewhat complex. It did not appear to be the case that individual differences could be explained by selective emphasis on some of the behaviors within the temporal clusters.

Smith comments on the lack of research relating observations of individual differences in behavior with observations on the temporal clustering of behavior, and suggests that variants of the factor-analytic technique he employed could pull out such relations. He notes that his clustering method could be improved on by combining the individual difference factor-analysis with the temporal clustering analysis.

2. Major implications for a definition of teaching: Not relevant.
3. Major implications for research methodology: This study points out the complementary nature of data analysis pointed toward finding temporal clusters of behavior (e.g., dominance and submissive behaviors)

and that aimed at delineating dimensions of individual difference (e.g., a tendency to be involved in agonistic situations). The possibility of combining these kinds of analysis should exist for any kind of observational data, from whatever orientation it might have emanated. For example, a teacher might employ certain kinds of non-verbal behaviors a great deal, and this might be a dimension of individual difference associated with other behaviors of interest (e.g., students stopping work and engaging in activities the teacher sees as disruptive). These kinds of analysis are complementary, and the relations between them should be an important factor in studying teaching.

4. Categories: Smith developed his categories so that they would make as few assumptions about motivation as possible, relying on overt motor patterns for his observational categories. Further, in order that his terms and their definition would correspond to readers' conceptions of the terms, he collected inter-observer reliability using an observer who had received no special training in the observation system, but had simply been supplied with the definitions and the procedure.
5. The nine elements:
 1. Students: Smith attempts to describe dimensions of individual differences in preschool children, which may extend in their applicability to elementary school age children. The major dimension he found in a factor analysis was one he labelled as a social maturity factor, measuring social interaction and withdrawal. The second factor was related to level of toy-manipulation, with some children tending to spend their time with movable toys, while others were more likely to spend their time playing on large immovable toys and engaging in rough-and-tumble play involving chasing and fleeing. Variations in these factors could quite conceivably influence a child's adaptation to schooling, inasmuch as it requires engaging in extensive small-object manipulation in a social situation, with rough-and-tumble play behaviors being fairly strictly proscribed.
 2. Teachers: Teachers may well show important individual differences in the manner in which they respond to individual differences in their students, resulting in classrooms in which different individual loadings on the above factors lead to different degrees of successful adaptation. The technique described by Smith also would allow study of individual differences in teacher behavior, as well as the relation between the teacher and student temporal clustering of behaviors.
 3. Other humans: Not relevant.
 4. Role: Not relevant.

5. Time: Not relevant.

6. Place: The data was not analyzed with respect to place, although that information was collected.

7. Task: Smith's data suggests that there are main individual differences related to preference for engaging in small-toy oriented behavior and large-object or chasing behavior. These preferences may be related to later satisfaction with and success in school, with different kinds of activities permitting expression of different preferences along this dimension.

8. Standards and sanctions: Not relevant.

9. Communication: The principal factor that emerged from the factor analysis was one labelled social maturity, which discriminated a tendency to withdrawal from social interaction such as talking with other children. This suggests that interest in and skill at communication may be a fundamental individual difference in young children.

6. Description of the study:

a) Behavior: Behavioral categories avoided judgments concerning the motivational origin of different actions, relying instead on specific motor patterns as they naturally occurred in the preschool setting. The clarity of the definitions of behavior was further assessed by calculating inter-rater reliability between the author and an outside observer supplied with definitions of the categories, finding high inter-observer agreement for most of the categories.

b) Setting: Observations were made during the free-play period in a municipal preschool program in England.

c) Treatment: Behaviors were observed as they occurred, without intervention.

d) Data collection: Observation periods were a half-minute each, with 100 observations being made on each child. During each observational period the observer would focus on 1 child, recording all the child's behavior that was relevant to the observational system. Observations on a given child were separated by at least 10 minutes, with 2 observations generally made on each child during each session.

e) Data analysis: To assess individual differences, Smith used a principal-components method factor analysis. He evaluated his factors by performing 3 factor analysis on subsets of the data in addition to the overall analysis, and comparing the

similarity of the resulting factors, eliminating unreliable factors. He evaluated the validity of the factor structure by referring to similarities between his factor structure and that found in previous factor-analytic studies of children's behavior.

Smith evaluated the temporal patterning of behavior by performing a cluster analysis on the observational records. He sorted the resulting clusters into a hierarchy selecting successively the pairs of behaviors and clusters with the highest positive correlation between each other and connecting them in the hierarchy. This led to a reduction in the number of his clusters and an increase in their generality, resulting in typical clusters involving non-toy behavior, dependency behaviors, stationary play, and agonistic behavior.

Smith then compared the two resulting factor analyses. He noted that if it were the case that individuals were simply described as "rough-and-tumble" individuals, "social interactive" individuals, etc., that the two analyses should lead to identical results. That they did not suggests that individual variations in behavior is primarily a result of individual emphasis on particular behaviors within the temporal groups. It should be noted that Smith's temporal clusters have limited face validity as measures of individual differences, with an example being the fact that dominant and submissive behaviors fall in the same cluster (due to their temporal co-occurrence). Further refinement of his categories could lead to a tight observational method related to demonstrated individual differences, which could be used in exploring the effects of different factors on behavior. Smith points out the possibility of this application, as well as the need for extensive further refinement of the methods employed in this study.

--Reviewed by Kevin Miller

Source: Smith, P., and Connolly, K. Patterns of play and social interaction in pre-school children. In N. Blurton-Jones (Ed.), Ethological studies of child behavior. London: Cambridge University Press, 1972.

1. Summary: The authors stress the need of general observational fact gathering as a prerequisite for experimental study of behavior. They note that extensive observation of child behavior occurred during the 1920's and 1930's, although these studies were flawed by a number of methodological weaknesses when compared with current ethological methods. Earlier studies were generally concerned with increasing desirable behaviors and decreasing undesirable behaviors, which led to a bias towards the observation of these kinds of behaviors rather than sampling from the entire behavioral repertoire of the child. Observational studies also generally used complex categories of behavior uncritically, which required observers to make extremely complex judgments (e.g., observing whether or not a child "misrepresents facts"). Use of these complex categories also required extensive training before inter-observer reliability was possible, which raises the problem that the categories might not correspond to common understanding of the meaning of the categories. There was also a nearly exclusive emphasis on age-sex norms of behaviors, without seeking explanations of behavior in terms of immediate environmental influences. Finally, there was a nearly complete lack of an inter-species perspective in observation, which in part explains why such behaviors as rough-and-tumble play (prominent in rhesus macaques as well as humans) were not observed in human play until recently.

In contrast to the above methods, the authors use behavioral categories defined with reference to overt motor patterns rather than motivational assumptions. In order to assess the similarity between their categories and common usage of the terms, they assessed reliability by comparing their results with those of an observer provided with the definitions of their categories but no specific training in using them, finding a high degree of concordance. They collected data related to location (indoors or outdoors), age, sex, presence of father in the home and socioeconomic status to create a balanced 2 x 2 x 5 design for the analysis of the effect of these variables on child behavior.

The authors note that an ethological approach to observation may be of only limited value in understanding the social behavior of children, since information concerning the overt behavior of a child has a different significance depending on the motivation and other contextual variables which are difficult to describe simply.

The authors studied behavior in 3 municipal preschools (children aged 2 years, 9 months to 4 years, 9 months) using a time sampling technique to observe free-play activity. Observations of the behavioral categories defined by the authors were analyzed in terms of sex-differences, age-differences, length of experience in the nursery school (which had a low correlation with age), location, time of day, and presence of the father. They found age-related differences in talking to other children and social play, which were more frequent among the older children, while

staring, crying, sucking, pointing and submissive/flight behaviors were more common among the younger group. Talking to another child and sucking were more frequent among girls, while play noises, rough-and-tumble play, and overall activity level were higher among boys. Sociability in play behavior, rough-and-tumble play, laughing and smiling were all correlated more highly with length of nursery experience than with age. There was more running, moving play, laughing, smiling, rough-and-tumble play outside, with less stationary play, staring, sucking or aggressive behaviors. No differences were related to time of day (morning versus afternoon).

A factor analysis of the resulting data (limited to only reliable categories and reliable factors) led to two major components, one of which was age-related and the other sex-related. The first component was labelled "social maturity" by the authors, and included positive loadings on social interaction, group play and nursery experience, with negative loadings on staring, looking-on, and stationary activity alone. The second primary factor involved whether or not play included small movable toys, and distinguished between play such as running, jumping and playing with immovable objects such as slides, as opposed to either group or individual play with toys. A third, smaller factor emerged which loaded positively on crying, sucking, and "puckered face." This was age-linked, and the authors interpreted the results as evidence that crying and sucking in younger children were frequently consequences of social interaction, while for older children they were indicative of isolation and withdrawal.

The authors note that the kind of information on the typical patterns of behavior associated with different age groups that they are gathering should allow investigation of the influences of particular environments on the behavior of children with particular characteristics.

2. Major implications for a definition of teaching: Not relevant to this study.
3. Major implications for research methodology: The author's emphasis on categories of overt behavior has some implications for methods of studying teaching, suggesting avoidance of categories that require complex motivational judgments on the part of the observers. They also suggest that it is more useful to attempt to describe the behavior that occurs in a situation rather than an immediate focus on behaviors believed on an a priori basis to be significant. Their results also suggest that factors such as social maturity can be induced from the behavior observation of children in preschools, which implies that they may well be important characteristics of children in elementary schools. It also suggests that differential preschool experience has effects on observable social behavior.

The use of outside observers to establish inter-observer reliability is also a promising method, since it ensures that the definitions of the categories provide all the information necessary to observe the relevant

behavior. The authors further used a split-half method to check the reliability of their factors (by performing separate factor-analysis on different halves of the data in order to compare the factor loadings of behaviors for the two subsamples). The stability of the behaviors assessed was evaluated by performing a split-half comparison of the results for each subject for the different behavioral categories.

4. Categories: The authors defined rough-and-tumble play as incidents of the following categories: wrestle, fall over; chase, flee; play beat, and group, moving, play, no toys involving run or hop, jump." These patterns were taken from the previous work by Harlow and Harlow (1965) and Blurton-Jones (1967).
5. The nine elements:
 1. Students: The sex, age and experience differences found by the authors in social behavior suggest that these may be important areas of differences for school-age children as well. The factors of social maturity or sociability and play with or without toys may have implications for the study of school-age children as well. The social maturity of school-age children may be evaluated using similar techniques, while the play with or without toys factor may represent a dimension of individual difference that persists into school.
 2. Teachers: Not relevant to this study.
 3. Other human elements: Not relevant.
 4. Role: The existence of sex-related differences in early social behavior may be related to later sex-role differences in the behavior and attitudes of school-age children. Boys without fathers showed more aggressive behavior than boys with fathers, and younger boys without fathers cried more than members of other groups. These role-related effects on behavior may well persist into the behavior of school-age children.
 5. Time: No time-related effects on behavior were found.
 6. Place: The study found that there were a number of significant differences between behavior indoors and outdoors, which may be due to the presence of increased space. The authors found a decrease in staring, sucking and aggressive behavior outside, while there was an increase in moving play, laughing, smiling, rough-and-tumble play, and wandering alone.
 7. Task: Not relevant.
 8. Standards: Not relevant.

9. Communication: Sex and age-related differences were found in vocalizations, with boys showing more play noises, and girls showing more talking, so that total frequency of vocalizations was the same.

6. Description of the study:

a) Behavior: The behavior was the naturally-occurring behavior of children in free-play at a municipal nursery school.

b) Setting: Municipal pre-school.

c) Treatment: None.

d) Data collection: The study used a time sampling technique. Twelve 5-minute samples were taken on each child, with ongoing behavior being sampled every 10 seconds during each sample. Observations were related to categories of facial expression, vocalizations, specific motor activities, agonistic behavior, specific social interactions, along with setting information, using a category system developed by the authors.

e) Data analysis: Frequencies of behaviors were evaluated as a function of variables such as age, sex, location, socio-economic status, presence of father in the home, and time of day. Reliable behavioral categories were also subjected to a factor analysis to illustrate dimensions of individual differences which existed in the sample. Reliability of the factor analysis was assessed by using a split-half method, replicating the factor analysis on separate halves of the sample. The validity of the factors was partially validated by reanalyzing data collected by Arrington in 1931, finding roughly similar principal components.

--Reviewed by Kevin Miller

Source: Smith, P.K. Aggression in a pre-school playgroup: Effects of varying physical resources. In J. Dewit and W. Hartup (Eds.), Determinants and origins of aggressive behavior. The Hague: Mouton, 1974.

1. Summary: This study combines naturalistic observation of agonistic behaviors in traditional ethological manner with experimental manipulation of two basic characteristics of the environment in which that behavior occurred. Variations in resource crowding and spatial crowding (c.f. #4 below) were made through manipulations of the physical environment, and the effects of these manipulations on occurrence of agonistic encounters were observed. In general, it was found that the incidence of agonistic encounters did not vary with the amount of space available, but decreased systematically as more play equipment was available. This study is one of the few extant that combine naturalistic observation with the organized manipulation of specific environmental characteristics. In addition, it explores characteristics of physical space that are relevant for studying classrooms, and suggests a distinction between spatial crowding (number of persons in a given area) and resource crowding (availability of various resources for individuals) that also may prove useful in the study of educational environments.
2. Major implications for the definition of teaching: This study observed a playgroup during which no teaching occurred, so this issue was not dealt with.
3. Major implications for studying teaching: The study employed a time-sampling technique to observe a variety of social behaviors. Agonistic encounters were scored in terms of the occurrence of behavioral units suggested by previous research, examples being: pushing a child, hitting or beating a child and physically or verbally dominating a child over possession of play equipment or spatial area. A second observer simply recorded incidents of agonistic behavior whenever they occurred, rather than using a time-sampling technique. These methods are certainly not unique, but this study illustrates the use of systematic observational techniques to record behavioral categories based on previous ethological research with both humans and other primates.
4. Categories and definitions: The author distinguished between three main types of crowding. Social crowding (more individuals in the same space) has been distinguished previously from spatial crowding (the same number of individuals in a smaller space). The author suggests that a third type of crowding must also be considered, that being resource crowding (fewer resources for the same number of individuals). This study compared the effects of two of these types of crowding, spatial and resource crowding.
5. The nine elements:
 - 1) Student: Children showed individual differences in both the extent to which they were involved in agonistic encounters

and the extent to which they won or lost such encounters in the cases where the outcome was clear. It was possible to create a reasonably linear dominance ranking of the individuals, suggesting that these individual differences were fairly consistent over time and between different pairings.

2) Teacher: Not a relevant category for this study.

3) Other human elements: Not a relevant category for this study.

4) Role: The existence of a fairly linear dominance hierarchy suggests that dominance may be a "role", to which humans may respond by behaviors such as deferment, appeasement, etc., depending upon positions in a dominance hierarchy. The current study does not explore this possibility, however.

5) Time: The study found a nonsignificant tendency in both groups studied for agonistic encounters to become more frequent through the morning. There was a systematic and significant decrease in agonistic encounters during the first 3 weeks of the study.

6) Place: The major thrust of this study explored the relations between physical space available and availability of resources. Physical space available was manipulated through the use of dividers to present either one, two or three equal-sized units of floor space to the children. There were no significant effects due to the amount of space available, and few agonistic encounters appeared to be over space per se. Space available did not interact with the resources available in the analysis of agonistic encounters.

Resources available were manipulated by presenting either one, two or three identical sets of a variety of toys to the children, and this manipulation had a number of effects. There was a significant decrease in the number of agonistic encounters as the number of toys available increased. This decrease was particularly pronounced for disputes over use of the less-popular toys. Decreasing the amount of play equipment had little effect on the overall frequency of object manipulation or use of apparatus and little or no effect on measures of social interaction, such as talking to other children. It did have the effect of increasing the size of the groups of children playing together, however. There was also more finger and thumb sucking as the toys available decreased. The author suggests that the children seem to have aimed at maintaining a constant level of object manipulation, and when fewer toys were available, this led to either choice of a less-desired toy or to increased sharing in a larger group of children.

7) Task: The author interprets the behavior of children in this unstructured environment as being directed toward a goal of a certain level of object-manipulation, suggesting that there are tasks even in apparently task-free settings.

8) Standards and sanctions: This category is not relevant to the current study.

9) Communication: The author does not report data relevant to this category.

6. Description of the study:

a) Behavior: The behavior of the subjects was their naturally-occurring behavior under a variety of social conditions of spatial and resource crowding. (c.f. #3 for a description of the types of behaviors sampled).

b) Setting: The setting was the basement of a church, which was used for two experimental playgroups over the course of approximately nine months.

c) Treatment: The treatments consisted of three levels of space available and three levels of toys available, presented in a Latin-square design, each environment being presented six times during the nine-month observational period.

d) Data sources and data collection methods: The author employed two schedules of behavior sampling, collected by two different observers. One observer observed each child according to a time-sampling method, while the other observer observed all incidents of agonistic encounters using an event-sampling method. Examples of the kinds of behaviors observed are described under category #3.

e) Data analysis: The main data analysis was an analysis of variance looking at the effects of space (amount of space available) and toys (number of toys available) on agonistic encounters.

--Reviewed by Kevin Miller

Source: Strayer, F.F. & Strayer, Janet. An ethological analysis of social agonism and dominance relations among preschool children. Child development, 1976, 47, 980-989.

1. Summary: This study applies the concept of a linear dominance hierarchy inferred from dyadic dominance relations to the social behavior of a group of pre-school aged children. The authors evaluate the consistency and linearity of the hierarchy inferred from videotaped samples of conflict episodes during observations of the children's free play. It is concluded that the concept of a dominance hierarchy as employed by researchers studying non-human primates may be usefully employed in studying human social groups, with the prospect of providing insights into both the phylogeny and ontogeny of peer-group social organization. The authors contend that such knowledge is essential for and adequate understanding of the processes of individual adaptation to the specific social pressures that are encountered during the course of development.
2. Major implications for a definition of teaching: Insofar as classroom teaching take place in the context of a socially-structured group, the dominance-relations among the members become potentially relevant for understanding teaching. In particular, it is quite likely that the kind of teaching that goes on in a situation in which the teacher's dominance is not established may be quite different from that which goes on when the teacher's dominance is unquestioned.
3. Major implications for studying teaching: This study is an example of the use of concepts derived from ethological research on nonhuman species to study aspects of human behavior. A behavioral inventory developed by the authors was employed with high reliability (.94) to code social behaviors recorded previously by videotaping. The videotapes were made using a matrix-completion method, attempting to record all episodes defined by broad behavioral categories, with priority being given to children on whom no previous observations had been made.

This general method, using loosely-defined categories to guide videotaping of classroom behavior, then coding the resulting tapes in terms of precise behavioral categories has a number of benefits for researchers studying teaching. It makes it much easier to assess the reliability of coders (and train coders) than would be the case if coding occurred as the behavior takes place. In addition, it creates permanent records which may be reanalyzed at a later date in the light of future findings.

4. Categories and definitions: Social agonism encounters were defined within three categories: physical attack, threat-gesture, and object/position struggle (behaviors within these categories will be described in category 6a below). Response categories were

divided into submission, help seeking, counterattack, object/position loss, and no response. Dyadic dominance relations were inferred for each pair for which there was relevant data by analyzing the responses and results of initiated conflict, rather than the tendency to initiate an agonistic encounter with another child. The group dominance hierarchy was defined as the aggregation of all the dyadic dominance relations, and was evaluated in terms of linear transitivity model (such that if individual A dominates individual B, and individual B dominates individual C, then individual A should also dominate individual C in a linear group dominance hierarchy).

5. The nine elements:

- 1) Student: An implication of this study is that a student is a member of a structured social group, with a position that may be described in terms of a linear group dominance hierarchy. The study suggests that dominance position would also be an element in the relations between individual students.
- 2) Teacher: Although there were no adults studied, the usefulness of a linear dominance hierarchy suggested by this study suggests that one important element in characterizing a teacher may be his or her position in a classroom dominance hierarchy, and how he or she responds to the dominance position of students in the classroom.
- 3) Other human elements: This category is not discussed in this article.
- 4) Role: The concept of role as "a framework for behavior" (Dawson, Tikunoff and Ward, 1978) seems an apt description of a group dominance hierarchy. The existence of a group hierarchy and the consistency of dyadic dominance relations with the group hierarchy suggests that the individual group members are in some sense acting in terms of their positions within the hierarchy. It is less clear that position in a dominance hierarchy is a role that exists "regardless of the specific performers," since position in a dominance hierarchy may very well be related to the characteristics of the specific members.
- 5) Time: The authors did not analyze their data with respect to time, although their discussion of possible functioning of a dominance hierarchy to reduce agonistic encounters implies that as a dominance structure develops (perhaps during the course of a school year), there should be a corresponding decrease in agonistic encounters.
- 6) Place: All observations occurred in the same setting. Hence, the study is not relevant to this category.

7) Task: The group was observed during free play activity, so that task was not a variable investigated.

8) Standards and sanctions: Approximately one out of every five agonistic episodes involved a counterattack by the target, and these generally led to a more extended agonistic episode. The authors report that these lengthy sequences almost always ended with one individual engaging in a submissive act. Counterattacks are one obvious example of a sanction to agonistic attacks functioning even in a preschool group. Other possible use of sanctions, such as seeking adult help, were extremely rare.

9) Communication: The threat-gestures category studied by the authors appear to represent non-verbal communication during agonistic encounters. The majority of such behaviors shown by these preschoolers were behaviors that directly resembled attack behaviors, although they did not result in physical contact. Examples are their categories of "intention hit," "intention kick" and "intention bite." They also describe a category called "face/body posture," consisting of a raised, protruding chin and a slight forward lean of the upper trunk, which often occurred with one or both hands resting on the hips.

The behaviors symbolizing submission also constitute non-verbal communication, the most common example being flinching.

Overall, these nonverbal communicative elements were important factors in determining the dominance relations between the members of this preschool playgroup.

6. Description of the study:

a) Behavior: A taxonomy of behaviors was developed from observations of the group over six weeks in the preschool group. Under the main heading of behaviors initiating agonistic encounters, were the following categories and specific behaviors:

1. Initiated agonism.

- a) physical attack (behaviors were: bite, chase, hit, kick push-pull and wrestle).
- b) threat-gesture (behaviors resembled physical attack but did not lead to physical contact, or consisted of nonverbal signals: intention hit, intention kick, intention bite, and face/body posture of threat, which usually consisted to a raised, protruding chin and a slight forward lean of the upper trunk.
- c) object/position struggle (consisting either of struggle with physical contact or struggle without physical contact).

Under the main category of responses to initiated agonism were the following subcategories and specific behaviors:

II. Responses to initiated agonism.

- a) submission (behaviors were: cry-scream, rapid-flight, cringe, hand cover, flinch, withdraw, and request cessation).
- b) help-seeking (either seeking help from adults or seeking help from peers).
- c) no response.
- d) counterattacks (any behavior which could be coded under the categories of initiated agonism above).
- e) object/position loss.

Videotapes were made by an observer familiar with this category system, recording encounters that could be coded under this system as they occurred. The observer used a matrix-completion method to give preference to collecting data on children who had not yet been recorded. This method maximized the number of dyads on whom some data was collected, while giving a biased estimate of individual differences in frequency of agonistic encounters.

b) Setting. Observations were conducted on a group of 18 preschool children at their preschool center at the end of the preschool year (during May, June, and July). Thus it was a natural setting.

c) Treatment: Data was collected by naturalistic observation of occurring behaviors, and the observers waited 6 weeks prior to collecting their data in order to allow the children to adjust to their presence.

d) Data gathering: The videotapes collected according to the procedure described in section 6a above were coded in terms of the taxonomy described in the same section.

e) Data analysis: To assess the appropriateness of a linear dominance hierarchy as a summary of the agonistic encounters observed, the authors calculated measures of the extent to which individual relations violated the expectation of linear transitivity (if A is dominant over B, who is dominant over C then A will be dominant over C), and rigidity of dominance relations (the extent to which individual episodes had outcomes that violated the dominance hierarchy prediction that the dominant individual would win). The linearity of dyadic relations was calculated according to the formula:

$$\% \text{ Linearity} = 100 \left\{ \frac{(\text{Total Dyads} - \text{Relational Reversals})}{\text{Total Dyads}} \right\}$$

where total dyads = number of dyads observed engaging in the specific form of conflict being assessed

and relational reversals = number of observed dyadic relationships violating the linear transitivity expectation.

The rigidity of dominance relations across episodes was calculated according to the formula:

$$\% \text{ Rigidity} = 100 \left(\frac{\text{Total episodes} - \text{Episodic reversals}}{\text{Total Episodes}} \right)$$

where total episodes = number of episodes observed involving a given category

and episodic reversals = episodes where the normally dominant individual submits or loses.

Analyzing the attacks and threats that led to a submissive gesture on the part of the other member of the dyad, the authors found that the linearity of these categories was 98% and the rigidity of the episodes was 95%. The unidirectionality of submissive behaviors did not characterize the initiation of agonistic encounters. The authors found that the rigidity of the initiation of agonism was only 75% rigid, implying that the targets of 25% of agonistic attacks were children who were higher-ranking in the dominance hierarchy. This supports the contention of the authors that the appropriate measure of dominance relations is the response to initiated agonism and the outcomes of the encounters, rather than the initiation of agonism.

--Reviewed by Kevin Miller

Source: Tinbergen, Niko. The innate disposition to learn. In M. Seligman and J. Hager (Eds.), Biological boundaries of learning. New York: Appleton-Century-Crofts, 1972.

1. Summary: This article provides a brief discussion of ethological understanding of animal learning, attempting to understand the relation between learning and the innate behavior patterns of the organism, the ontogenetic development of the organism, and the function that the learning serves, as well as the conditions that require the organism to learn a particular behavior pattern, rather than inheriting it ready-made through its genotype.

Starting point of the discussion is the observation that animals learn some things much more readily than others that logically should be no more difficult. From this beginning, Tinbergen develops the concept of limited and localized "dispositions to learn", limited to certain periods of development (so-called critical periods), certain types of stimuli, and certain response patterns.

2. Major implications for a definition of teaching: Although human learning is not discussed in this article, to the extent that this analysis is directly applicable to human beings, teaching would be seen as the provision of specific experiences relevant to those characteristics of the environment that the organism must come to understand through learning, at the specific points in time when the organism is receptive to that lesson.
3. Major implications for studying teaching: The ethological approach of using behavioral observation in natural environments to determine the adaptive function and evolutionary history of behavior has been discussed elsewhere. Concepts such as that of critical periods in learning suggests research aimed at determining the ontogenetic points when children are most receptive to being taught certain kinds of skills under particular conditions. If, as Tinbergen suggests, organisms inherit specific dispositions to learn as part of their innate equipment, it behooves the investigator to determine what these dispositions are in the subjects of his study. As an example, extrapolating from Tinbergen's discussion of Greenland Eskimo dogs, it may be that certain elementary school children are not very receptive to certain kinds of sex education or learning about social structure, at the same time that they may quickly acquire this information as they approach sexual maturity. This speculative example is supplied merely as an example of the kind of hypothesis concerning critical periods of learning that an investigator of teaching might find it worthwhile to pursue.
4. Categories and Definitions: Tinbergen introduces a number of concepts that are not standard in educational literature, providing illustrations from animal literature. Examples are:

1. strictly localized dispositions to learn: As an example, hive bees and other Hymenoptera can rapidly learn the cues for the

location of their nests. Tinbergen describes a study of his in which he arranged a set of pine cones in a particular arrangement around a wasp's nest. The wasp left the nest, made a circular locality study flight lasting six seconds, then flew away. On her return, she went to a nearby location to which the pine cones had been moved in preference to the actual nest site. Tinbergen notes that this rapid learning ability is not consistent with the general learning abilities of wasps in other circumstances.

2. preferential learning: Tinbergen reports that a herring gull forced to choose between its empty nest and its eggs that have been removed to an artificial nest about a foot away will almost always prefer the accustomed next site to the nest with eggs. Thus, the herring gull responds to the cue of locality in preference to the cue of herring gull cases.

3. critical periods of learning: Tinbergen discusses the Eskimo dogs of Greenland, who live in territorial packs of 5-10 individuals. He reports that immature dogs don't defend their own territory and often roam into the territory of other packs, despite being attacked and chased out of it. Shortly after sexual maturity, however, and often within the course of a week, the dogs defend their own territory and cease to trespass into the territory of other packs. A more popular example is the sexual imprinting of a number of precocial birds, originally observed by Lorenz in greylag geese. Under cases where these birds are raised by members of different species, including humans, they later seek sexual partners from the other species in preference to their own.

5. The nine elements:

1) Student: The student is viewed as an organism that has inherited a substantial array of innate equipment, including a disposition to learn about characteristics of its environment that are nonconstant and also important to its adaptation.

2) Teacher: The teacher seems to be a person limited to human beings, and hence it is not discussed in this article.

3) Other human elements: are not discussed in the article.

4) Role: Tinbergen describes examples of bird species in which position in a dominance hierarchy is an important variable controlling social interactions. He describes the case of jackdaws, birds who show very poor ability to discriminate their own young, yet who quickly react to the mating of a low-ranking female with a high-ranking male by giving her the same status as that of her mate. This is an example of a

case in which dominance-position is an important role attribute to discern for jackdaws, with the result that even birds that are very limited intellectually are able to quickly learn it.

5) Time: The concept of critical periods for learning during the ontogenetic development of an organism suggests that this may be an important "time" factor. Learning occurs at a certain point in the organisms life-cycle, and Tinbergen suggests that there is frequently localization of the point in ontogenesis at which learning can or will take place.

6) Place: This category is not specifically discussed in the article. The concept that the disposition to learn is an evolved trait, and that learning is more likely to occur under the conditions for which it evolves has some implications for this category. A classroom setting, defined as one in which a small number of adults teach a larger number of children in a constant physical setting, may or may not differ significantly from the conditions under which learning occurred during man's evolutionary history (although it probably does differ substantially). The implications of Tinbergen's theory is that successful teaching is less likely to take place under conditions different from those under which it evolved.

7) Task: This category is not discussed directly, although the concept that learning is a strictly localized disposition suggests that this might be an important variable, since it should be much easier to teach children some things more than others, according to the importance of a particular skill in human evolutionary history.

8) Standards and sanctions: This category is not discussed, although the theory implies that the need for and the utility of rewards and sanctions should vary greatly across different tasks, such that the use of sanctions may be more necessary in teaching a student some characteristic of mathematics or grammar than it would be to teach him how to find his way around his community.

9) Communication: This category is not discussed.

--Reviewed by Kevin Miller

Sources: Tinbergen, Niko. "Forward" In N. Blurton-Jones (Ed.), Ethological Studies of Child Behavior. London: Cambridge University Press, 1972.

Tinbergen, Niko. Ethology in a Changing World. In P.P.G. Bateson and R. Hinde (Eds.), Growing Points in Ethology. London: Cambridge University Press, 1976.

1. Summary: These articles are reviewed together because, taken together, they provide Tinbergen's views on a number of aspects of human ethology and education. The first article provides a capsule history of ethology, stressing "the basic task of observation and description of the natural phenomena that have to be understood." Tinbergen considers this task of observation to be essential to building a science. Psychology is criticized as a behavioral science that prematurely dropped the task of naturalistic observation in return for laboratory-oriented research plagued by a "pre-occupation with too few phenomena and too few methods." Tinbergen warns that current attitudes towards ethology range between an uncritical acceptance of the "ethologisms" of popularizers such as Desmond Morris and rejection of the entire approach in reaction to such overstated claims. Instead, he suggests that a complete understanding of human behavior hinges on the development of a human ethogram, a description of the behavioral norms of human beings against which pathology and intervention may be evaluated.

The second article discusses human ethology in greater depth. Tinbergen asserts that the uniqueness of human beings as a species lies in our ability to evolve culturally, to "transfer typically acquired behaviour programming ('experience' or 'knowledge') from each generation to the next." This capacity has enabled us to change our environment as well as adapt to it, although he suggests that this is a mixed blessing. Human beings have changed their environment in both its material and psychosocial aspects to such an extent that Tinbergen suggests that human beings are now in a phase of disadaptation, or loss of viability. Human beings faced the task of adapting to declining material resources and increasing population pressure, pressures so rapid that they must be responded to be cultural rather than genetic changes.

In the face of the increasing disadaptation of man to his environment, the task of education must be to use human genetic characteristics to reduce this disadaptation.

2. Major implications for a definition of teaching: Teaching is defined as the use of knowledge about man's genetic heritage in the service of increasing adaptation (or decreasing disadaptation) to current or prospective environmental conditions. Tinbergen asserts that "if we could steer our fears, our hostility, and our considerable potential for social cooperativeness towards attacking, not our fellow-men, but the negative feedbacks of our cultural evolution, we might with luck succeed in a united attack on our disadaptation." The characteristics of teaching requisite to this task that Tinbergen discusses are: 1) a "biologically more balanced form of education" that stresses playful, exploratory and imitative self-teaching, and 2) a reasoned appeal to the "deep-rooted motivations that are part of our genetic heritage", such as the human tendency towards social cooperation.

3. Major implications for studying teaching: Tinbergen's assertion that any science must begin by detailed observation of the phenomena of interest in its natural environment has direct application to the study of teaching. It suggests that students of teaching must begin with the creation of an "ethogram of teaching" by studying the behavioral regularities of teaching and other classroom behavior as it occurs in natural classrooms. Tinbergen suggests further that there are four (non-mutually-exclusive) levels on which behavior can be explained, and that an understanding of each is necessary for an exhaustive understanding of the behavior involved. These categories are:

- 1) immediate causation
- 2) survival value for the organism
- 3) ontogeny of the behavior
- 4) phylogeny of the behavior.

Thus for teaching, it may prove fruitful to consider the immediate causes of kinds of teaching (e.g., government regulations, union contracts, etc.), the survival value of the behavior (e.g., the role it plays in ensuring the viability of the teacher and the student, as, for example, a source of income for the teacher), the ontogeny of teaching (what is the set of prior experiences that a teacher brings to teaching that enable him or her to teach?), and the role the behavior plays in the species, if it is species-general behavior (what is it about human beings that leads to the occurrence of mature adults spending time teaching immature children in a group setting?).

4. Categories and definitions (cf. #1)

5. The nine elements:

1) Student: To the extent that the role of "student" is one that is a species-general characteristic, students are naturally prepared to show student-type behaviors (e.g., an eagerness to learn). If learning-ability is a human characteristic that has been selected-for during human evolution, and Tinbergen implies that it has, then students should show a willingness to learn those skills that have proved to be necessary to adaptation. This may not, however, appear as a generalized willingness to learn. Thus, an eagerness to sit in a chair for extended periods of time and listen to an adult speaker may not be a characteristic of students, at the same time that an eagerness to learn the language of their culture is.

2) Teacher: The teacher may also show an innate tendency to teach, although this would probably be the tendency to teach the young that all adult humans may show, rather than a particular desire to teach that some individuals may show. A teacher's behavior should be considered in terms its contribution to the teacher's adaptation, its ontogenetic antecedents, and any phylogenetic contributions, as well as the immediate and apparent causes of such behavior. (Note: as mentioned above, these considerations are general ones that may be applied to any question of interest).

- 3) Other human elements: are not specifically mentioned by Tinbergen, nor are any considerations raised that were not discussed under the labels "student" and "teacher" above.
- 4) Role: Tinbergen suggests that the existence of roles, in terms of relations between persons with different statuses in a dominance hierarchy, may be a part of human genetic endowment. Thus, an understanding of a classroom dominance hierarchy, and the position of the teacher within that, would be an important characteristic of classroom interaction to study. It is also likely that relations between children and adults may be partially species-defined roles. If this is the case, then these role positions would also represent critical information.
- 5) Time: is not discussed.
- 6) Place: Tinbergen asserts that territoriality is a basic element of human social groups. This suggests that the use of territorial demarcations to delineate the territory of different groups may be an important phenomena to study in classrooms.
- 7) Task: is not discussed.
- 8) Standards and sanctions: In light of the discussion of role (# 4 above), standards and the sanctions that enforce them might be role characteristics in certain cases. Thus, the relations between a child and an adult might be regulated by certain species-characteristic behaviors, such as the use of appeasement gestures by the child to represent his or her inferior position in a dominance organization.
- 9) Communication: is not discussed.

--Reviewed by Kevin Miller

Source: Tymitz, B. & Omark, D. A naturalistic observation of verbal discipline modeling in a first grade classroom. Instructional Science, 1978, 7, 81-94.

1. Summary: This study examined the effectiveness of specific discipline techniques used by a classroom teacher and a student teacher in maintaining classroom control. (See item 4 and 6c for discussion of definitions used in the study.)
3. Major implications for studying teaching: A combination of sampling techniques was used in order to define what constitutes effective classroom discipline in behavioral terms. (See item 6d for description of the specific methods and their purposes.)
4. Categories: A desist was defined in this study as a loud verbal command (p. 88), which is a specific type of what Kounin defined as a desist incident: a teacher's action to stop deviancy or misbehavior.
5. The nine elements: The two elements, role and standards are most likely to affect the nature and frequency of desists in the classroom. In particular, the results of the study indicated that the kind and frequency of the student teacher's desists changed over the 8-week session as she took over more of the classroom teacher's major tasks and responsibilities. This study did not provide information about classroom standards.
6. Description of the study: The study examined natural behavior of students, a student teacher (ST), and a classroom teacher (CT) in a first-grade classroom during reading and mathematics lessons.

There were two phases of the study, both of which focused on behavior related to discipline episodes. Phase I employed an Ad Lib sampling technique (Altmann, 1974) in order to note and categorize student and teacher behavior surrounding a discipline episode. During this phase, the student teacher was merely observing the class. The classroom teacher and the observer independently identified six "disruptive, dawdling" children who would be observed carefully in Phase II.

Phase II combined two sampling methods, Focal Child and All Occurrences of Some Behaviors (Altmann, 1974) in order to address the following questions:

1. Does ST adopt CT desist techniques?
2. Is there a difference in children's behavior that follows a CT remark vs. behavior following a ST remark?
3. Are certain CT-ST interactions more effective for inducing or maintaining on-task behavior?

Focal children (2 males, 2 females) were observed for 15 minutes per hour period. The following behaviors, defined in Phase I, were recorded sequentially as observed:

1. noisy - loud talking, inappropriate noise
2. aggression - starting to hit, hitting, pushing
3. not attending - daydreaming, playing with clothing, toys
4. peer transaction - peer seeks attention of target child
5. transaction with peer - target child seeks attention of peer
6. traveling - walking, running in room, beginning from target child's desk
7. inappropriate work - not working on assigned task for lesson
8. not-on-task - behaviors which do not relate to completion of the assigned task
9. housekeeping - target child maintains personal space or community materials
10. on-task - doing appropriate task for lesson
11. other - verbal and non-verbal behavior not included above.

During each one-hour period, all desist incidents were recorded. If the desist was directed toward a target child, the observer continued to record the child's behavior and if directed toward any of the other children or to the group, the observer recorded the other children's behavior for one minute following the incident. Three categories were used to define the content of teacher desist statements:

1. describing - teaching desists by making a statement such as, "It's getting very noisy in here" or "I wish we could all hear Henry."
2. managing - teaching desists by making a statement such as "Sharon, go to your seat."
3. threatening - teacher desists by making a statement such as "If you don't stop talking, you will not be first in the hot lunch line."

The data analysis was fairly simple. The results were presented in tables showing the frequencies of the 3 types of desist statements for the ST and CT, and the sequences of student behaviors following desists. Briefly, the results indicated the following. The CT had three times as many desists as the ST, the number of ST desists increased over the 8-week period, both teachers desisted for the same behaviors, and a sequence of student behavior following a desist by the CT was more likely to contain on-task behavior than one following a desist by the ST.

--Reviewed by Susan Frey

Source: Wickler, W. The ethological analysis of attachment: Sociological, motivational, and sociophysiological aspects. Zeitschrift fur Tierpsychologie, 1976, 42, 12-28.

1. Summary: (For a definition of attachment, please see section 4.)

Taking an evolutionary approach to behavior, the author suggests that there are two measurable benefits from attachment. The first is that attachment can serve to maximize the individual's genetic contribution to future generations by successfully bringing and keeping together specialized individuals in cooperative efforts. Secondly, attachment allows individuals to economize their efforts to survive by monopolizing their investments, i.e., by focusing one's interest on one individual (or place), a person builds up experience that allows him to predict regularly occurring events. Both of these benefits are called sociophysiological aspects because they cannot be studied adequately by looking at one individual or a group that is just a multiple of one individual. Rather, interindividual differences need to be taken into account.

The idea of an attachment drive is discussed. The author concludes that "there is no unitary attachment drive. Instead, animals adjust their behaviour constantly to a benefit/cost ratio." (p. 27) Thus, the observed attachments are a result of many different factors, both biological and environmental. If information is available about group size, density, freedom of movement, age and sex composition, as well as about the network of attachments, predictions may be made about the ways in which a social system may react to changing ecological conditions.

4. Categories: Attachment is defined as "a long-lasting state of readiness of the individual to be attracted to a particular set of stimuli." (p. 13) The term attachment connotes directionality while "the term bond indicates some relationship between an individual and another individual or object." (p. 18)

There are several operational criteria for attachment. The first is association in space over a period of time or "proximity-maintaining." For example, "a group may be identified by measuring the mean distances between individuals over a certain period of time." (p. 13) The smallest group is a pair, defined as two individuals who spend time in closer proximity to one another than to any other individual. In order to make sure that proximity in space is not a result of other factors besides attachment, one can experimentally move certain individuals to induce following by the individual being studied. Another criteria is that an individual shows attachment by showing one or more behavior patterns preferably or exclusively toward the individual or object of attachment. To find out which partner contributes more to developing the attachment, a researcher can calculate frequencies of approach and leaving, which are expressed in terms of percentage of total activity observed. Whoever devotes a greater share of activity to approaching his or her partner than to leaving it contributes more to the attachment.

One can define approach and leaving in terms of body orientation with respect to the partner, different types of walks, or by using sequential position data. Proximity in time, shown by specific call-and-answer behaviors, can indicate attachment. Bird calls are an example. It is likely that in the classroom, attached partners could be identified by noting verbal and non-verbal call-and-answer behaviors when the partners are not close spatially.

5. The nine elements: The network of attachments among students in a classroom could be studied in order to reveal interactions between the elements place and student.

--Reviewed by Susan Frey--